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City of Boston
Town of Brookline

Phase 1 Muddy River Flood Control, Water Quality and Habitat Enhancement, and Historic Preservation Project

Executive Summary
Full Report and Appendices on CD-ROM
EOEA #11865
Draft Environmental Impact Report

December 2001

Prepared By: **CDM**

In Association with:

Jason M. Cortell and Associates Inc.
Pressley Associates, Inc.
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Summary

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January 21, 2002

Mr. Robert Durand
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Subject: Draft Environmental Impact Report; EOEA#11865
Phase I Muddy River Flood Control, Water Quality and
Habitat Enhancement, and Historic Preservation Project

Dear Secretary Durand:

On behalf of the City of Boston and the Town of Brookline, we are forwarding to you three copies of the Draft Environmental Impact Report in compliance with MEPA Regulations (301 CMR 11.00-Section 11.06) and the ENF Certificate you issued on April 24, 1999.

Please note that over the past six months, the Citizens' Advisory Committee you established has provided both comment on and input to the content of the DEIR, most of which have been incorporated into the draft. Furthermore, as required by MEPA Regulations (301 CMR 11.00-Section 11.09) and your Certificate establishing a Special Review Procedure (April 24, 1999), this DEIR has been submitted to the CAC for their final review, 30 days in advance of this formal submittal to MEPA.

In addition, comments received on the ENF and your Certificate have been summarized and responded to. These can be found in Appendix K.

Finally, the Proponents are requesting that the comment period be extended to 60 days allowing, to the greatest possible extent, the public to comment on the DEIR.

Copies of the DEIR (either in hard copy or CD form) are available from John Burckardt, BPRD's project manager, via e-mail at jburckardt@ci.boston.ma.us, by telephone at 617-635-4505, or in writing at, BPRD, 1010 Massachusetts Avenue, Boston, MA 02118.

Very truly yours,

Bruce R. Conklin

Bruce R. Conklin, P.E.
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Attachment: DEIR Circulation List (301 CMR 11.16)

c: Margaret Dyson, BPRD
Thomas Brady, Town of Brookline

Phase 1 Muddy River Project Flood Control, Water Quality and Habitat Enhancement, and Historic Preservation Project

EOEA File No. 11865

Draft Environmental Impact Report

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Date of Filing: January 31, 2002

Muddy River Rehabilitation Project
Emerald Necklace
Boston and Brookline, Massachusetts

Vision Statement

The Emerald Necklace is an internationally renowned 19th-century linear park system and a nationally significant work of landscape architecture, sanitary engineering, and city planning. Frederick Law Olmsted Sr., the leading landscape architect of that era, created these public spaces to solve a difficult series of public health and civil engineering problems and provide verdant scenery to "bring peace and refreshment to the city dweller". The spine of the Emerald Necklace, the Muddy River, a 3.5-mile linear system, integrates glades, dells, sweeping vistas, reflecting pools, the Babbling Brook, bike paths, walkways, tree-lined parkways, shorelines and "beaches". This unified system of linked parks is one of the most uniquely designed historic urban waterways in the nation. The challenge today is to achieve a balance between historic landscape preservation principles, resource protection regulations, public safety measures and modern engineering practices.

Fredrick Law Olmsted, Sr.
Landscape Architect
Emerald Necklace, Boston

As a result of changes in land use patterns associated with urbanization, both the engineering and the artistry of Olmsted's creation are in need of renovation. The most serious issue is the presently diminished flood handling capacity of the park system as evidenced by the damage caused by two recent storms that brought civic leaders, politicians, and community groups together to reexamine the condition of this natural treasure and its importance to the metropolitan area. With increasing regularity, moderate rains necessitate emergency response measures to address storm water overflow in Fenway colleges and universities, Longwood medical institutions, numerous Brookline businesses and residences and the public transit facilities. The commitment of political will associated with health, safety and ecological improvements to Olmsted's municipal masterwork has inspired a multi-jurisdictional park and public works project to restore the Muddy River's civil engineering structure, flood-carrying capacity, historic integrity, bucolic scenery and ecological vitality.

The Muddy River Rehabilitation project is one of the most ambitious and comprehensive landscape preservation projects in the nation. The vision

set forth for recovering Olmsted's original concept of a unified system of linked parks is designed to protect the health, safety and welfare of the citizens, re-establish the Olmsted scenery to approach its former glory, and reinvigorate the overall park experience for the benefit of everyone in the community.

The project, which includes improvements to infrastructure, dredging sediment, removing invasive species, rehabilitating and restoring wetland habitats and historic resources addresses the predominant stresses that currently undermine the park system. Invasive exotic vegetation has overtaken large areas of the river and its banks. Over five acres of mature *Phragmites* (a tall invasive reed grass) choke the river and diminish the flood-carrying capacity of the waterway. The reeds have displaced other plant species and undermine biodiversity. Contaminants in the river sediment continue to degrade water quality, limiting the number of vertebrate and invertebrate species that could contribute to a balanced ecology. The Muddy River Rehabilitation will correct major issues of physical deterioration, public safety hazards and address critical public needs.

The collaboration process that created the rehabilitation project remains as important as the project itself. Over the past years, the municipalities have been implementing park improvements using the framework of the Massachusetts Department of Environmental Management's 1990 *Emerald Necklace Master Plan*. The project vision exemplifies a renewed appreciation of the Emerald Necklace and reinforced political will to commit resources to rehabilitate a world-class park system. Coordinated maintenance and management can successfully reclaim many areas. The municipalities are committed to exploring new and innovative ways to maintain the parks in perpetuity, and protect and preserve the public sector's investment. Boston and Brookline will aggressively pursue partnerships with private sector and cultural institutions, and examine fiscal and organizational models that could enhance park maintenance and management practices. A Memorandum of Understanding (MOU) signed in 1999 by local and state agencies institutionalizes the commitment of collaboration and cooperation amongst the respective authorities in project planning, permitting, funding, and implementation.

One hundred years ago, Olmsted believed that nature could restore the human mind and spirit and conceived the unique urban landscape called the Emerald Necklace to bring a natural regenerative experience to city dwellers. Like their 19th century predecessors, today's civic leaders, politicians, and citizens must commit to stewardship for future generations, and sustain a legacy worthy of Olmsted and his peers. Across the country, Olmsted has left millions of urban residents some of this country's greatest treasures. Our citizens and their elected officials have come together in an exceptional effort to protect those treasures for the next generations.

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Contents

Contents

Executive Summary

Section 1 - Introduction

1.1 Historical Background....1-6
1.2 Components of the Master Plan....1-7
  1.2.1 Project Phasing....1-17
1.3 MEPA Review Procedures....1-19
  1.3.1 Special Review Procedures....1-19
  1.3.2 Establishment of the Citizen's Advisory Committee....1-21
  1.3.3 Annual Update....1-21
1.4 State and Local MOU for Funding and Administering the Project....1-23
1.5 Project Permitting....1-23
  1.5.1 Massachusetts Wetlands Protection Act....1-24
  1.5.2 Federal Section 106 Background....1-24
  1.5.3 Army Corps of Engineers/Federal Emergency Management Agency Environmental Assessment....1-27
1.6 Summary of Previous Engineering and Environmental Studies....1-27
  1.6.1 Flood Control....1-28
  1.6.2 Sediment Quality....1-28
  1.6.3 Water Quality....1-28
  1.6.4 Wildlife....1-29
1.7 Project Objectives....1-29
  1.7.1 Provide Flood Control....1-29
  1.7.2 Improve Water Quality....1-30
  1.7.3 Enhance Aquatic and Riparian Habitat....1-31
  1.7.4 Preserve Landscape and Historic Resources....1-32
1.8 Purpose and Organization of the DEIR....1-35

Section 2 - Project Alternatives

2.1 Providing Flood Control....2-2
  2.1.1 No Action....2-4
  2.1.2 Infrastructure Improvements – Riverway to Fens Bridge....2-4
  2.1.3 Increase Upstream Storage....2-29
  2.1.4 Flood Proofing of Property....2-32
  2.1.5 Dredging....2-33
2.2 Improvement of Water Quality....2-63
  2.2.1 No Action....2-64
  2.2.2 Elimination of Illegal Sewer Connections....2-65
  2.2.3 Sewer Separation....2-65
  2.2.4 Point Source Control....2-66

2.2.5 Implementation of Best Management Practices for Stormwater Runoff 2-66
2.2.6 Flow Augmentation 2-66
2.2.7 Aeration 2-69
2.2.8 Harvesting of Aquatic Vegetation 2-69
2.2.9 Dredging and Improvement of Sediment Quality 2-69
2.2.10 Screening of Water Quality Enhancement Alternatives 2-70
2.3 Enhancing Aquatic and Riparian Habitat 2-72
2.3.1 No Action 2-74
2.3.2 Improvement of Water Quality 2-75
2.3.3 Bank to Bank Dredging 2-75
2.3.4 Removal of Invasive Vegetation and Planting of Wetland and Riparian Vegetation 2-76
2.3.5 Restoration of the Historic Islands and Enhancement of the Existing Island 2-78
2.3.6 Enhancing Fish Spawning Habitat 2-79
2.3.7 Restoration of Flow to the Babbling Brook 2-79
2.3.8 Screening of Aquatic and Riparian Habitat Enhancement Alternatives 2-80
2.4 Treatment of Landscape and Historic Resources 2-82
2.4.1 No Action (Preservation Treatment) 2-82
2.4.2 Implementation of the 1990 Emerald Necklace Master Plan (Rehabilitation Treatment) 2-84
2.4.3 The Primary and Secondary Periods of Significance (Restoration Treatment) 2-85
2.5 Best Management Practices 2-87
2.5.1 No Action 2-95
2.5.2 Source Control Options 2-95
2.5.3 Treatment Control Options 2-107
2.5.4 Summary of BMP Alternatives 2-112
2.6 Screening of Project Alternatives and Selection of the Recommended Plans 2-114

Section 3 – Public/Agency Involvement

3.1 MEPA Requirement for Public Involvement 3-1
3.2 Citizen's Advisory Committee (CAC) 3-2
3.2.1 Emerald Necklace CAC Membership 3-2
3.2.2 CAC Meetings 3-4
3.3 Technical Advisory Group 3-12
3.4 Public Participation 3-12
3.5 Agency Coordination 3-13
3.5.1 Agency Outreach 3-13
3.5.2 Pre-Application Review Committee 3-15

3.6 Public Participation During Development of Final Environmental Impact Report 3-18
3.7 Public Participation During Design 3-18
3.8 Public Participation During Construction 3-18

Section 4 - Existing Conditions

4.1 Study Area Description 4-1
  4.1.1 Charlesgate Area 4-10
  4.1.2 Back Bay Fens 4-10
  4.1.3 The Riverway 4-13
  4.1.4 Leverett Pond 4-15
  4.1.5 Willow Pond 4-15
  4.1.6 Wards Pond 4-15
4.2 Charlesgate 4-17
  4.2.1 Physical Environmental Features 4-17
  4.2.2 Biological Environment 4-23
  4.2.3 Cultural Environment 4-26
  4.2.4 Traffic 4-35
4.3 Back Bay Fens 4-36
  4.3.1 Physical Environmental Features 4-36
  4.3.2 Biological Environment 4-47
  4.3.3 Cultural Environment 4-54
  4.3.4 Traffic 4-65
4.4 The Riverway 4-67
  4.4.1 Physical Environmental Features 4-67
  4.4.2 Biological Environment 4-77
  4.4.3 Cultural Environment 4-84
  4.4.4 Traffic 4-96
4.5 Leverett Pond 4-98
  4.5.1 Physical Environmental Features 4-98
  4.5.2 Biological Environment 4-106
  4.5.3 Cultural Environment 4-114
  4.5.4 Traffic 4-122
4.6 Willow Pond 4-123
  4.6.1 Physical Environmental Features 4-123
  4.6.2 Biological Environment 4-130
  4.6.3 Cultural Environment 4-138
  4.6.4 Traffic 4-143
4.7 Wards Pond 4-146
  4.7.1 Physical Environmental Features 4-146
  4.7.2 Biological Environment 4-149
  4.7.3 Cultural Environment 4-157
  4.7.4 Traffic 4-164

Section 5 -Project Design and Construction

5.1 Charlesgate Area 5-2
  5.1.1 Channel Dredging and Dredge Material Management 5-2
  5.1.2 Resulting Flood Control 5-5
  5.1.3 Construction Staging 5-5
  5.1.4 Traffic Management for Construction 5-6
  5.1.5 Landscape and Historic Resources 5-9
5.2 Back Bay Fens 5-10
  5.2.1 Channel Dredging and Dredged Material Management 5-11
  5.2.2 Daylighting of Culverted Sections 5-16
  5.2.3 Culvert Enlargement 5-20
  5.2.4 Resulting Flood Control 5-24
  5.2.5 Construction Staging 5-24
  5.2.6 Traffic Management for Construction 5-26
  5.2.7 Landscape and Historic Resources 5-30
5.3 Riverway 5-35
  5.3.1 Channel Dredging and Dredge Material Management 5-37
  5.3.2 Invasive Species Removal 5-40
  5.3.3 Construction Staging 5-40
  5.3.4 Traffic Management for Construction 5-40
  5.3.5 Landscape and Historic Resources 5-43
5.4 Leverett Pond 5-49
  5.4.1 Dredging and Dredge Material Management 5-51
  5.4.2 Construction Staging 5-51
  5.4.3 Traffic Management 5-52
  5.4.4 Landscape and Historic Resources 5-52
5.5 Willow Pond 5-57
  5.5.1 Dredging and Dredge Material Management 5-58
  5.5.2 Landscape and Historic Resources 5-58
5.6 Wards Pond 5-62
  5.6.1 Dredging and Dredge Material Management 5-62
  5.6.2 Landscape and Historic Resources 5-64
5.7 Best Management Practices for Stormwater Runoff 5-66
  5.7.1 Basin-Wide Source Control BMP's 5-71
  5.7.2 Basin-Wide Treatment Control BMP's 5-72
  5.7.3 Charlesgate Area 5-73
  5.7.4 Back Bay Fens 5-74
  5.7.5 The Riverway 5-76
  5.7.6 Leverett Pond 5-77
  5.7.7 Willow Pond 5-78
  5.7.8 Enforcement and Monitoring of Best Management Practices 5-78
  5.7.9 Costs for Best Management Practices 5-79
5.8 Construction Phasing and Schedule 5-80

5.9 Cost Estimate 5-84

Section 6 -Assessment of Impact/Environmental Consequences

6.1 Assessment of Environmental Impacts in the Charlesgate Area 6-1
6.1.1 Physical Environmental Features 6-1
6.1.2 Biological Environment 6-8
6.1.3 Cultural Environment 6-10
6.1.4 Traffic 6-12
6.2 Assessment of Environmental Impact in the Back Bay Fens 6-14
6.2.1 Physical Environmental Features 6-15
6.2.2 Biological Environment 6-24
6.2.3 Cultural Environment 6-38
6.2.4 Traffic 6-39
6.3 Assessment of Environmental Impact in The Riverway 6-46
6.3.1 Physical Environmental Features 6-46
6.3.2 Biological Environment 6-55
6.3.3 Cultural Environment 6-63
6.3.4 Traffic 6-66
6.4 Assessment of Environmental Impact in Leverett Pond 6-69
6.4.1 Physical Environmental Features 6-71
6.4.2 Biological Environment 6-76
6.4.3 Cultural Environment 6-83
6.4.4 Traffic 6-87
6.5 Assessment of Environmental Impact at Willow Pond 6-89
6.5.1 Physical Environmental Features 6-90
6.5.2 Biological Environment 6-92
6.5.3 Cultural Environment 6-99
6.5.4 Traffic 6-103
6.6 Assessment of Environmental Impacts at Wards Pond 6-104
6.6.1 Physical Environmental Features 6-104
6.6.2 Biological Environment 6-106
6.6.3 Cultural Environment 6-113
6.6.4 Traffic 6-117

Section 7 – Environmental Mitigation

7.1 Mitigation Management 7-3
7.2 Environmental Mitigation for Construction Activities in the Charlesgate Area 7-3
7.2.1 Dredged Materials Management Plan 7-5
7.2.2 Stormwater/Dewatering Pollution Prevention Plan 7-7
7.2.3 Construction Period Water Quality Monitoring 7-8
7.2.4 Parkland Monitoring 7-8
7.2.5 Traffic Control During Construction 7-9

7.2.6 Restoration of the Construction Site 7-9
7.2.7 Charlesgate Area Draft Section 61 Findings 7-10
7.3 Environmental Mitigation for Construction Activities from the Back Bay Fens through Wards Pond 7-15
7.3.1 Dredged Materials Management Plan 7-15
7.3.2 Stormwater/Dewatering Pollution Prevention Plan 7-17
7.3.3 Construction Period Water Quality Monitoring 7-19
7.3.4 Parkland Monitoring 7-20
7.3.5 Plan for the Monitoring of Wetland, Shoreline, and Landscape Restoration 7-20
7.3.6 Rodent Control 7-20
7.3.7 Public Outreach Program 7-21
7.3.8 Traffic Control During Construction 7-21
7.3.9 Habitat Protection, Mitigation and Enhancement for the Three Spine Stickleback 7-22
7.3.10 Noise Mitigation at Brookline Avenue Culvert 7-25

Section 8 – Management and Maintenance Plan

8.1 Introduction 8-1
8.1.1 Goals 8-3
8.2 Management and Resource Structure 8-4
8.2.1 Existing Management Structure 8-8
8.2.2 Cooperative Management Structure 8-9
8.2.3 Public/Private Partnership 8-12
8.2.4 Entity Under Environmental Joint Powers Act 8-13
8.2.5 Park Commission or Authority 8-13
8.2.6 Other Resources to Management Organizations 8-14
8.3 Accountability 8-14
8.3.1 Environmental Reporting Framework-The MEPA Annual Update 8-15
8.3.2 Maintenance Environmental Permits and Approvals 8-16
8.3.3 Reports and Logs – Quality Assurance 8-17
8.4 Park Maintenance Activities and Workload 8-19
8.4.1 Maintenance Standards 8-19
8.4.2 Maintenance Guidelines 8-21
8.5 Resources for Management and Maintenance 8-23
8.5.1 Staff 8-23
8.5.2 Equipment 8-26
8.5.3 Closing the Gap 8-27
8.6 Management and Maintenance Recommendations 8-29
8.6.1 Management Recommendations 8-29
8.6.2 Maintenance Recommendations 8-30

8.7 Monitoring and Maintenance Practices Culverts and Best Management Practices 8-31
    8.7.1 Culvert Maintenance 8-31
    8.7.2 Maintenance of Source Control BMPs 8-31
    8.7.3 Maintenance of Treatment Control BMPs 8-33
    8.7.4 BMP Monitoring/Maintenance Logs 8-34
8.8 Corrective and Maintenance Measures Following Specific Storm Events 8-34
    8.8.1 Preventative Measures 8-34
    8.8.2 Corrective Measures 8-34
    8.8.3 Emergency Action Plan 8-35
8.9 Pest and Rodent Control 8-36
    8.9.1 Local Ordinances and Public Education 8-37
    8.9.2 Planting of Natural Barriers 8-37
    8.9.3 Implementation of Reproductive Controls 8-37
8.10 Monitoring and Inspections 8-38
    8.10.1 Water Quality Monitoring Plan 8-38
    8.10.2 Observations on the Growth and Success of Shrubs, Wetland and Other Habitat Plantings 8-39
    8.10.3 Monitoring of Fish and Wildlife Distribution and Reproduction 8-40
    8.10.4 Monitoring of Maintenance of Historic and Character Defining Features 8-41
8.11 Maintenance Costs 8-42
    8.11.1 Annual Cost of Maintenance of BMP 8-43
    8.11.2 Equipment 8-46

Section 9 – Statutory and Regulatory Standards and Requirements
9.1 Overview 9-1
    9.1.1 MA Wetland Protection Act Interests and Regulation 10.53(4) 9-1
    9.1.2 Section 106 of the National Historic Preservation Act 9-5
    9.1.3 Waste Quality Certification 9-6
    9.1.4 Section 404 of the Federal Clean Water Act 9-6
9.2 Charlesgate 9-8
    9.2.1 Primary Regulatory Standards 9-8
    9.2.2 Charlesgate Permits/Approvals 9-10
9.3 Balance of the Proposed Phase I Work – Back Bay Fens, The Riverway, Leverett Pond, Willow Pond, and Wards Pond 9-13
    9.3.1 Back Bay Fens 9-13
    9.3.2 The Riverway 9-15
    9.3.3 Leverett Pond 9-17
    9.3.4 Willow Pond 9-19
    9.3.5 Wards Pond 9-21
    9.3.6 Permits/Approvals – Remainder of the Project Area 9-23

Section 10 – Funding Strategy

10.1 Overview 10-1
10.1.1 Funding Received to Date 10-1
10.1.2 Additional Capital Funding 10-2
10.1.3 Maintenance Funding 10-3
10.2 Committed and Potential Funding Sources 10-3
10.3 Committed Funding Sources: US Army Corps of Engineers 10-5
10.3.1 Description of Programs 10-5
10.3.2 Actions Taken To Date 10-5
10.3.3 Follow-Up Activities 10-7
10.4 Committed Funding Sources Boston and Brookline 10-8
10.4.1 Description of Program 10-8
10.4.2 Actions Taken To Date 10-8
10.4.3 Follow-Up Actions 10-10
10.5 Committed Funding Sources: Massachusetts Special State Legislation 10-11
10.5.1 Description of Programs 10-11
10.5.2 Actions Taken To Date 10-11
10.5.3 Follow-Up Activities 10-11
10.6 Good Potential: Environmental Protection Agency 10-12
10.6.1 Description of Program 10-12
10.6.2 Actions Taken To Date 10-12
10.6.3 Follow-Up Actions 10-12
10.7 Good Potential Massachusetts Department of Environmental Mangement 10-12
10.7.1 Description of Program 10-12
10.7.2 Actions Taken To Date 10-12
10.7.3 Follow-Up Actions 10-13
10.8 Good Potential: State Revolving Fund 10-14
10.8.1 Description of Program 10-14
10.8.2 Actions Taken To Date 10-14
10.8.3 Follow-Up Actions 10-14
10.9 Limited Potential: Massachusetts Demonstration Grants 10-14
10.9.1 Description of Program 10-14
10.9.2 Actions Taken To Date 10-15
10.9.3 Follow-Up Actions 10-15
10.10 Limited Potential: National Park Service (NPS) 10-15
10.10.1 Description of Programs 10-15
10.10.2 Actions Taken to Date 10-16
10.10.3 Follow-up Actions 10-16
10.11 Limited Potential: National Endowment for the Arts/Humanities 10-16
10.11.1 Description of Programs 10-16
10.11.2 Actions Taken to Date 10-17
10.11.3 Follow-up Actions 10-17

10.12 Limited Potential: Housing and Urban Development Funding 10-17
  10.12.1 Description 10-17
  10.12.2 Actions Taken to Date 10-17
  10.12.3 Follow-up Actions 10-17
10.13 Limited Potential: Federal Emergency Management Agency 10-18
  10.13.1 Description of Programs 10-18
  10.13.2 Actions Taken to Date 10-18
  10.13.3 Follow-up Actions 10-19
10.14 Summary of Capital Funding 10-19
10.15 Funds for Operations and Maintenance 10-21
10.16 The Role and Commitment of Private Institutions 10-22
11.0 Glossary & Abbreviations 11-1

Appendices

Volume 2 Appendix A Emerald Necklace Parks Master Plan

Volume 3 Appendix B Wetland Delineation
Appendix C Inventory of Horticultural, Historic Resources and Archaeological Reports

Volume 4 Appendix D Wildlife Habitat Evaluation and Vegetation Assessment
Appendix E Flood Analysis

Volume 5 Appendix F Sediment Characterization
Appendix G Water Quality

Volume 6 Appendix H Structural Report
Appendix I Preliminary Design Report

Volume 7 Appendix J ETM Associates, L.L.C – Draft Maintenance Plan
Appendix K Comments and Responses
Appendix L Regulatory and Agency Correspondence

Volume 8 Appendix M CAC and Public Meeting Material

Figures

Figure 1-1, Site Location 1-2
Figure 1-2, Project Objectives 1-4
Figure 1-3, Aerial Extent of Flooding, Oct. 1996 1-5
Figure 1-4, Phase I Project Area 1-18
Figure 1-5, MEPA Flow Chart 1-20
Figure 1-6, Special Review Procedures 1-22

Figure 2-1, Alternative Screening 2-1
Figure 2-2, Areas of Proposed Improvements Riverway To Avenue Louis Pasteur... 2-5
Figure 2-3, Former Sears Parking Lot Proposed Improvements ACOE – Straight Channel 2-7
Figure 2-4, Upstream of Avenue Louis Pasteur Proposed Improvements ACOE – Straight Channel 2-8
Figure 2-5, Former Sears Parking Lot Proposed Improvements – Channel Closely Matches Historic 2-9
Figure 2-6, Upstream of Avenue Louis Pasteur Proposed Improvements – Channel Matches Historic 2-12
Figure 2-7, Former Sears Parking Lot Proposed Improvements – Channel with Modified Historical Alignment 2-13
Figure 2-8, Arch Culvert Vs. Box Culvert Detail 2-15
Figure 2-9, Riverway Proposed Improvements – Culvert Replacement – East Side 2-16
Figure 2-10, Riverway Proposed Improvements – Culvert Replacement – West Side 2-17
Figure 2-11, Riverway Proposed Improvements - Culvert Enlargement – West Side 2-18
Figure 2-12, Riverway Proposed Improvements - Culvert Enlargement – East Side 2-19
Figure 2-13, Flow Schematic of Brookline Avenue Gatehouse 2-21
Figure 2-14, Brookline Avenue Proposed Improvements – Open Face of Gatehouse to Provide Overflow – Abandon Existing Drains 2-23
Figure 2-15, ACOE Proposed Improvements to Provide Overflow to Brookline Gatehouse 2-24
Figure 2-16, Brookline Avenue Proposed Improvements – Use Existing Drains to Serve as Overflow 2-25
Figure 2-17, Brookline Avenue Proposed Improvements – Direct Overflow Connection to Gatehouse 2-26
Figure 2-18, Avenue Louis Pasteur Proposed Improvements – Dredge Existing Culvert 2-28
Figure 2-19, Avenue Louis Pasteur Proposed Improvements – Culvert Enlargement 2-30

Figure 2-20, Avenue Louis Pasteur Proposed Improvements – Culvert Replacement 2-31
Figure 2-21, Barge-Mounted Crane with Environmental Clam Shell Bucket 2-35
Figure 2-22, Barge-Mounted Excavator 2-37
Figure 2-23, Hydraulic Dredge Barge 2-39
Figure 2-24, Potential Staging Areas 2-46
Figure 2-25, Charlesgate Area 2-48
Figure 2-26, Lower Fens North Basin & Agassiz Road Staging Area and Cross Section Locations 2-49
Figure 2-27, Lower Fens Southern Basin & Lagoon (Jersey Street) Staging Area...... 2-50
Figure 2-28, Upper Fens Pond & Louis Pasteur Staging Area 2-52
Figure 2-29, Riverway North & Netherlands Road Staging Area 2-53
Figure 2-30, Ward's Pond, Willow Pond and Leverett Pond and Daisy Field Staging Area 2-54
Figure 2-31, Cross Sections of Back Bay Fens 2-60
Figure 2-32, Screening of Flood Control Alternatives 2-62
Figure 2-33, Water Quality Improvement Alternatives 2-68
Figure 2-34, Water Quality Improvement Measure - Dredging Alternatives 2-71
Figure 2-35, Screening of Water Quality Alternatives 2-73
Figure 2-36, View from St. Mary's Street Footbridge 2-79
Figure 2-37, Willow Pond Headwall 2-81
Figure 2-38, Screening of Aquatic/Riparian Habitat Alternatives 2-83
Figure 2-39, Sediment Loads Over Time 2-96
Figure 2-40, Sources of Sediment 2-98
Figure 2-41, Vegetated Swale 2-110

Figure 4-1, Historic Emerald Necklace Plan 4-2
Figure 4-2, Phase I Project Area 4-3
Figure 4-3, Muddy River and Stony Brook Watersheds 4-7
Figure 4-4, Muddy River Drainage System 4-8
Figure 4-5, Stony Brook System Schematic Including Muddy River and MWRA Boston Marginal Conduit 4-9
Figure 4-6, Charlesgate Area 4-11
Figure 4-7, Back Bay Fens 4-12
Figure 4-8, The Riverway 4-14
Figure 4-9, Olmsted Park 4-16
Figure 4-10, Peak Hydraulic Grade Line - October 1996 Storm Existing Conditions - Charlesgate Area 4-19
Figure 4-11, Muddy River Sampling Stations 4-22
Figure 4-12, Back Bay Revised Plan of the Northerly Part including Beacon Entrance 4-28
Figure 4-13, Planting Plan for the Beacon Street Entrance 4-29
Figure 4-14, Map of the Back Bay Fens, Commonwealth Avenue, Beacon Street and Audubon Road 4-30

Figure 4-15, Charles River Basin Preliminary Plan 4-31
Figure 4-16, Charlesgate East and West, Arthur A. Shurtleff, 1930's 4-32
Figure 4-17, Muddy River Restoration
Charlesgate Area Existing Traffic Conditions 4-34
Figure 4-18, Peak Hydraulic Grade Line – October 1996 Storm Existing Conditions - Back Bay Fens 4-39
Figure 4-19, Simulated Velocities in the Muddy River Dowstream of the Riverway October 1996 Storm 4-40
Figure 4-20, Muddy River Sampling Stations 4-45
Figure 4-21, Proposed Improvement of Back Bay, 1879 4-55
Figure 4-22, View of Back Bay as a Tidal Basin, 1890's 4-56
Figure 4-23, Map of the Back Bay Fens, Commonwealth Avenue, Beacon Street and Audubon Road, 1887 4-58
Figure 4-24, Revised General Plan for Back Bay Fens 4-59
Figure 4-25, Revised General Plan for Back Bay Fens 4-59
Figure 4-26, Excavating, Dredging, Filling and Loaming in the Fens 4-60
Figure 4-27, Aerial Photo Overlooking the Victory Garden Area 4-61
Figure 4-28, Muddy River Restoration
Back Bay Fens Area Existing Traffic Conditions 4-64
Figure 4-29, The Riverway 4-68
Figure 4-30, Peak Hydraulic Grade Line - October 1996 Storm
Existing Conditions - Riverway 4-70
Figure 4-31, Simulated Velocities in the Riverway Section of the Muddy River October 1996 Storm 4-71
Figure 4-32, Muddy River Sampling Stations 4-75
Figure 4-33, Plan of Proposed Muddy River Improvements Showing Contours 4-86
Figure 4-34, Plan of the Parkway Between Muddy River Gate House and Jamaica Park 4-87
Figure 4-35, Riverway Under Construction 4-88
Figure 4-36, View Upstream from Longwood Bridge 4-89
Figure 4-37, Riverway, Topographic Plan for Planting Study 4-90
Figure 4-38, Riverway Footbridge near Brookline Avenue at Netherlands Road 4-91
Figure 4-39, Muddy River Restoration Riverway Area Existing Conditions 4-95
Figure 4-40, Olmsted Park 4-99
Figure 4-41, Muddy River Sampling Stations 4-104
Figure 4-42, Plan of Proposed Muddy River Improvements Showing Contours 4-116
Figure 4-43, Plan of the Parkway Between Muddy River Gatehouse and Jamaica Park 4-117
Figure 4-44, View Over Leverett Pond from Allerton Street Overlook 4-118
Figure 4-45, View of Leverett Pond Cove Bridge 4-119
Figure 4-46, Muddy River Restoration Leverett Pond/Willow Pond/Wards Pond Area Existing Traffic Conditions 4-121
Figure 4-47, Olmsted Park 4-124
Figure 4-48, Willow Pond Outlet 4-125

Figure 4-49, Three Spine Stickleback....4-133
Figure 4-50, Plan of Proposed Muddy River Improvements Showing Contours.....4-139
Figure 4-51, Plan of the Parkway Between Muddy River Gatehouse and Jamaica Park 4-140
Figure 4-52, View of Willow Pond Toward Willow Pond Road Culvert Bridge......4-141
Figure 4-53, Muddy River Restoration
Leverett Pond/Willow Pond/Wards Pond Area Existing Traffic Conditions.........4-145
Figure 4-54, Olmsted Park 4-147
Figure 4-55, Plan of Proposed Muddy River Improvements Showing Contours.....4-158
Figure 4-56, Plan of the Parkway Between Muddy River Gate House and Jamaica Park 4-160
Figure 4-57, View of Wards Pond Looking Towards Perkins Street....4-159
Figure 4-58, Grading Plan at Wards Pond....4-162
Figure 4-59, Wards Pond from Near Jamaicaway Looking North Towards Chestnut Street....4-163
Figure 4-60, Muddy River Restoration
Leverett Pond/Willow Pond/Wards Pond Area Existing Traffic Conditions.........4-165

Figure 5-1, Charlesgate Area 5-4
Figure 5-2, Charlesgate Area, Potential Staging Area Access/ Egress Plan for Construction Traffic.... 5-7
Figure 5-3, Proposed Regional Truck Haul Routes.... 5-8
Figure 5-4, Lower Fens Northern Basin and Cross Section Locations.... 5-13
Figure 5-5, Lower Fens Southern Basin Channel Location 5-14
Figure 5-6, Cross-Sections of Back Bay Fens 5-15
Figure 5-7, Flood Control Facilities Riverway to Avenue Louis Pasteur 5-18
Figure 5-8, Cross-Section of a Daylighted Channel 5-19
Figure 5-9, Back Bay Fens Area Sears Rotary Proposed Culvert Replacement Implementation Plan.... 5-22
Figure 5-10, Back Bay Fens Area, Potential Staging Area Access/Egress Plan for Construction Traffic 5-27
Figure 5-11, Back Bay Fens Area, Agassiz Road Traffic Diversions for General Traffic 5-28
Figure 5-12, Typical Healthy Ecosystem Cross Section.... 5-32
Figure 5-13, Typical Healthy Olmsted Turf Covered Bank Section.... 5-33
Figure 5-14, Back Bay Fens Survey (July 1921) with Historic Island 5-34
Figure 5-15, Simulated Velocities in the Riverway Section of the Muddy River, October 1996 Storm 5-38
Figure 5-16, Cross-Sections of Riverway Dredging 5-39
Figure 5-17, *Phragmites* Removal Area in Riverway North.... 5-41
Figure 5-18, *Phragmites* Removal Area in Riverway South 5-42
Figure 5-19, Riverway Area Potential Staging Area Access/Egress Plan for Construction Traffic 5-44

Figure 5-20, Riverway Area Netherlands Road Traffic Diversions for General Traffic 5-45
Figure 5-21, Looking Downstream from the St. Mary's Footbridge, 1907 5-46
Figure 5-22, The Parkway Topographic Plan for Planning Study, Section 1, from Brookline Avenue to St. Mary's Street, 1893, F.L. Olmsted 5-48
Figure 5-23, Leverett/Willow/Wards Pond Area Potential Staging Area, Access/Egress Plan 5-53
Figure 5-24, Grading Plan Brookline Road from Washington Street to Cumberland Avenue (December 1891), F.L. Olmsted 5-55
Figure 5-25, Willow Pond Waterfall from History Pool 5-61
Figure 5-26, East Side of Wards Pond Looking South (c. 1900) 5-66
Figure 5-27, Muddy River Watershed BMP Implementation Plan 5-70

Figure 6-1, Charlesgate Area 6-2
Figure 6-2, Peak Hydraulic Grade Line - October 1996, Existing and Improved Conditions - Charlesgate Area 6-4
Figure 6-3, Charlesgate Area Potential Staging Area Access/Egress Plan for Construction Traffic 6-13
Figure 6-4, Lower Fens Southern Basin & Lagoon (Jersey Street) Staging Area 6-16
Figure 6-5, Peak Hydraulic Grade Line - October 1996 Storm, Existing and Improved Conditions - Back Bay Fens 6-18
Figure 6-6, Typical Cross Section in Back Bay Fens 6-20
Figure 6-7, Typical Plant Massing Proposed for the Back Bay Fens, near the Victory Gardens 6-27
Figure 6-8, Typical Plant Massing Proposed for the Back Bay Fens 6-28
Figure 6-9a, Cross Sections of Bank Revegetation Areas in the Riverway 6-32
Figure 6-9b, Cross Sections of Bank Revegetation Areas in Back Bay Fens 6-33
Figure 6-10, Back Bay Fens Area, Potential Staging Area Access/Egress Plan for Construction Traffic 6-43
Figure 6-11, Back Bay Fens Area, Agassiz Road Traffic Diversions for General Traffic 6-44
Figure 6-12, Back Bay Fens Area, Sears Rotary Proposed Culvert Replacement Implementation Plan 6-45
Figure 6-13, Riverway South & Netherlands Road Staging Area 6-48
Figure 6-14, Simulated Velocities in the Riverway Section of the Muddy River, October 1996 Storm 6-50
Figure 6-15, Peak Hydraulic Grade Line - October 1996 Storm, Existing and Improved Conditions – The Riverway 6-51
Figure 6-16, Cross Sections of Riverway Dredging 6-53
Figure 6-17, Typical Plant Massing Proposed for the Riverway, Netherlands Road Area 6-59
Figure 6-18, Typical Plant Massing Proposed for the Riverway, Island Area 6-60
Figure 6-19, Cross Sections of Bank Revegetation Areas in The Riverway 6-61

Figure 6-20, Riverway Area, Potential Staging Area, Access/Egress Plan for Construction Traffic 6-67
Figure 6-21, Riverway Area, Netherlands Road Traffic Diversions for General Traffic 6-68
Figure 6-22, Leverett/Willow/Wards Pond and Daisy Field Staging Area 6-72
Figure 6-23, Typical Plant Massing Proposed for Leverett Pond, Pond Avenue Area 6-79
Figure 6-24, Typical Plant Massing Proposed for Leverett Pond, "Babbling Brook" Area 6-80
Figure 6-25, Leverett/Willow/Wards Pond Area, Potential Staging Area, Access/Egress Plan 6-88
Figure 6-26, Typical Plant Massing Proposed for Willow Pond 6-96
Figure 6-27, Typical Plant Massing Proposed for Wards Pond, West 6-109
Figure 6-28, Typical Plant Massing Proposed for Wards Pond, East 6-110

Figure 7-1, Construction Management Structure 7-4
Figure 7-2, Silt Curtain and Oil Absorbent Boom 7-6
Figure 7-3, Hay Bales and Silt Fencing 7-7
Figure 7-4, Mud Cat Dredge at Hardy Pond, Waltham, MA 7-15
Figure 7-5, Belt Filter Press at Hardy Pond, MA 7-17
Figure 7-6, Dewatered Filter "Cake" Being Loaded at Hardy Pond, Waltham, MA 7-18

Figure 8-1, Phase I Project Area 8-2
Figure 8-2, Park and Drainage Area Management Structure 8-10

Tables

Table 1-1, Emerald Necklace Master Plan Elements.. 1-8

Table 2-1, Summary of Phase I DEIR Alternatives 2-2
Table 2-2, Existing Best Management Practices (BMPs)
Phase I Muddy River Flood Control, Water Quality and Habitat Enhancement...... 2-88
Table 2-3, Alternatives Matrix and Recommended Alternatives..............................2-115

Table 4-1, Historic Resources In and Near the Emerald Necklace (Boston) 4-4
Table 4-2, Historic Resources In and Near the Emerald Necklace (Brookline)............ 4-6
Table 4-3, Summary of Sediment Analytical Results – Charlesgate Area.................. 4-20
Table 4-4, Inventory and Analysis of Existing Vegetation – Charlesgate 4-24
Table 4-5, Pedestrian Volume Summary – Charlesgate Area 4-33
Table 4-6, Traffic Volume Summary – Charlesgate Area 4-36
Table 4-7, Summary of Sediment Analytical Results – Back Bay Fens....................... 4-41
Table 4-8, Inventory and Analysis of Existing Vegetation – Back Bay Fens 4-48
Table 4-9, Wetland Function – Value Evaluation Form for Back Bay Fens................ 4-52
Table 4-10, Pedestrian Volume Summary – The Back Bay Fens Area........................ 4-63
Table 4-11,Traffic Volume Summary – The Back Bay Fens Area............................... 4-66
Table 4-12, Summary of Sediment Analytical Results - Riverway 4-73
Table 4-13, Inventory and Analysis of Existing Vegetation - Riverway..................... 4-78
Table 4-14, Wetland Function – Value Evaluation Form for The Riverway 4-82
Table 4-15, Pedestrian Volume Summary – The Riverway Area............................... 4-94
Table 4-16, Traffic Volume Summary – The Riverway Area 4-97
Table 4-17, Summary of Sediment Analytical Results – Leverett Pond 4-102
Table 4-18, Inventory and Analysis of Existing Vegetation – Leverett Pond............4-107
Table 4-19, Wetland Function – Value Evaluation Form for Leverett Pond 4-111
Table 4-20, Traffic Volume Summary – The Leverett Pond Area.............................4-122
Table 4-21, Summary of Sediment Analytical Results – Willow Pond......................4-127
Table 4-22, Inventory and Analysis of Existing Vegetation – Willow Pond 4-131
Table 4-23, Wetland Function – Value Evaluation Form for Willow Pond...............4-135
Table 4-24, Traffic Volume Summary – Willow Pond Area.....................................4-144
Table 4-25, Summary of Sediment Analytical Results – Wards Pond.......................4-148
Table 4-26, Inventory and Analysis of Existing Vegetation – Wards Pond 4-150
Table 4-27, Wetland Function – Value Evaluation Form for Wards Pond................4-154
Table 4-28, Traffic Volume Summary – Wards Pond Area 4-166

Table 5-1, Project Objectives Met by Charlesgate Area Project Elements 5-3
Table 5-2, Project Objectives Met by Back Bay Fens Area Project Elements 5-12
Table 5-3, Project Objectives Met by Riverway Area Project Elements...................... 5-36
Table 5-4, Project Objectives Met by Leverett Pond Project Elements....................... 5-50

Table 5-5, Project Objectives Met by Willow Pond Project Elements 5-59
Table 5-6, Project Objectives Met by Wards Pond Project Elements 5-63
Table 5-7, Summary of Watershed BMPs 5-67
Table 5-8, Volumes of Sediment to be Removed by Over Dredging 5-75
Table 5-9, Summary of Capital Costs for Watershed BMPs 5-81
Table 5-10, Muddy River Restoration Project, Construction Cost Estimate Based on Conceptual Design 5-85

Table 6-1, Trip Generation Estimate for Dredging Operations 6-14
Table 6-2, Proposed Wetland, Shrub and Canopy Plantings for Habitat and Historic Value 6-29
Table 6-3, A Comparison of the Present and Proposed Future Extent of Resource Areas in the Back Bay Fens as Defined in 310 CMR 10.00 6-34
Table 6-4, Wetland Function-Value Evaluation Form for the Back Bay Fens 6-36
Table 6-5, Trip Generation Estimate for Dredging and Culvert Construction 6-40
Table 6-6, Construction Operations Impacts – Back Bay Fens Area (the Sears Rotary) 6-42
Table 6-7, A Comparison of the Present and Proposed Future Extent of Resource Areas in The Riverway as Defined in 310 CMR 10.00 6-62
Table 6-8, Wetland Function-Value Evaluation Form for The Riverway 6-64
Table 6-9, Traffic Operations Impacts – Riverway Area 6-70
Table 6-10, A Comparison of the Present and Proposed Future Extent of Resource Areas in Leverett Pond as Defined in 310 CMR 10.00 6-81
Table 6-11, Wetland Function-Value Evaluation Form for Leverett Pond 6-84
Table 6-12, A Comparison of the Present and Proposed Future Extent of Resource Areas in Willow Pond as Defined in 310 CMR 10.00 6-98
Table 6-13, Wetland Function-Value Evaluation Form for Willow Pond 6-100
Table 6-14, A Comparison of the Present and Proposed Future Extent of Resource Areas at Wards Pond as Defined in 310 CMR 10.00 6-111
Table 6-15, A Comparison of Present and Proposed Future Extent of Resource Areas in Project Area as Defined in 310 CMR.10.00 6-112
Table 6-16, Wetland Function-Value Evaluation Form for Wards Pond 6-114

Table 7-1, Mitigation of Project Impacts 7-2

Table 8-1, Comparison to Other Park Models 8-6
Table 8-2, Annual Review Calendar, Schedule of Strategy Meetings and Review Sessions 8-11
Table 8-3, Summary of Monitoring/Inspections 8-17
Table 8-4, Sample Maintenance Log 8-38
Table 8-5, Increased Planting from Muddy River Restoration Project 8-20
Table 8-6, Summary of Hours Needed to Maintain the Project Area Parks 8-21
Table 8-7, Current Full-Time Equivalent Staff Project Area 8-25
Table 8-8, Summary of Additional Hours for Each Entity 8-26

Table 8-9, Summary of O and M Costs for Watershed BMPs 8-44
Table 8-10, Summary of O and M Costs 8-47

Table 9-1, Charlesgate Area: Comparison of Project Elements with Project Objectives and Regulatory Interests/Standards.. 9-9
Table 9-2, Back Bay Fens: Comparison of Project Elements with Project Objectives and Regulatory Interests/Standards... 9-14
Table 9-3, Riverway: Comparison of Project Elements with Project Objectives and Regulatory Interests/Standards... 9-16
Table 9-4, Leverett Pond: Comparison of Project Elements with Project Objectives and Regulatory Interests/Standards... 9-18
Table 9-5, Willow Pond: Comparison of Project Elements with Project Objectives and Regulatory Interests/Standards... 9-20
Table 9-6, Wards Pond: Comparison of Project Elements with Project Objectives and Regulatory Interests/Standards... 9-22
Table 9-7, Proposed Scope of the MEPA Annual Update 9-25

Table 10-1, Allocated Funding to Date 10-1
Table 10-2, Funding Sources 10-4

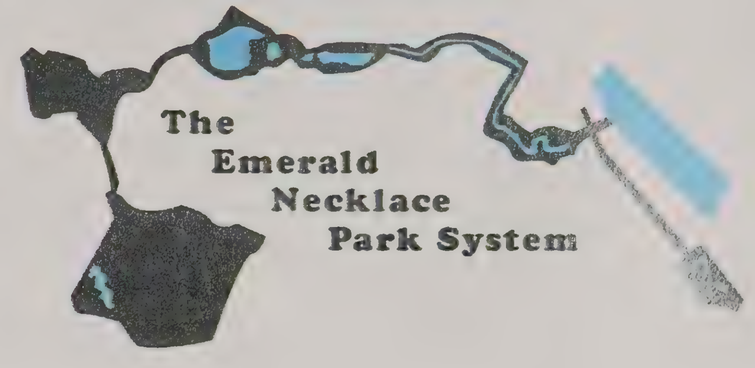
Executive Summary

Executive Summary

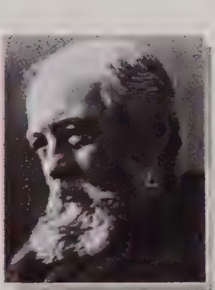
Rehabilitating the Emerald Necklace

What is the Emerald Necklace?

The Emerald Necklace is the oldest park system in the United States and the largest in Boston — a swath of hills, meadows, other open spaces, and waterways as unique and diverse as the 300,000 people who live in its watershed. Stretching more than six miles from Dorchester to Back Bay, the Emerald Necklace is composed of six parks and related waterways:



- Franklin Park (Scarboro Pond)
- Arnold Arboretum
- Jamaica Park (Jamaica Pond)
- Olmsted Park (Ward's, Willow, and Leverett Ponds)
- The Riverway
- The Back Bay Fens, which joins the Riverway via the Muddy River



The Emerald Necklace is the only remaining intact linear park designed by renowned landscape architect, Frederick Law Olmsted.

The Emerald Necklace is valued not only in Boston, but also on a national level because of its great history. Nearly a century ago, the City of Boston and Town of Brookline hired America's first landscape architect, Frederick Law Olmsted, to create special green "retreats" for city-dwellers. Answering the challenge, Olmsted planned, designed, engineered, and constructed the parks, waterways, and vehicular and pedestrian parkways known as the Emerald Necklace. Among his many impressive accomplishments — including design/construction of New York's Central Park, Chicago's Washington and Jackson Parks, and Detroit's Belle Isle Park — Olmsted's Emerald Necklace is considered the most complex:

- It's functional, improving sanitary conditions and flood control.
- It's multifaceted, serving as an educational and recreational resource.
- It's cohesive, uniting diverse, urban neighborhoods by green space.

In the middle of a busy city, millions find respite in the Emerald Necklace.

Olmsted's social vision — that the parks bring "peace and refreshment" and serve as "meeting grounds for people of different

What is the Emerald Necklace?

- A National Treasure – 1,000 acres of green space listed on the National Register of Historic Places
- A State Resource – a Boston landmark and "front door" to dozens of our cultural, medical, and educational institutions
- An Urban Jewel – green "retreats" where people escape city life conveniently, without leaving the city
- An Environmental Legacy – diverse in vegetation, wildlife, and opportunity for passive and active recreation.

classes and backgrounds" – is still true today. It's no wonder the Emerald Necklace is listed on the National Register of Historic Places. And it's no wonder that many of Boston's world-renowned cultural, medical, and educational landmarks – such as the Museum of Fine Arts, Children's Hospital, and the Berklee College of Music – were built adjacent to the Emerald Necklace. What is a wonder is the Emerald Necklace: it's as important in defining Boston's and Brookline's identities as the diverse neighborhoods, monuments, museums, nationally-recognized medical facilities, and world-class learning institutions that lie adjacent to its boundaries.

This Muddy River Project is the First Step toward Rehabilitation

Created more than a century ago by a visionary who believed that nature could restore the human mind and spirit, the parks and waterways within the Emerald Necklace need rehabilitation.

This need was first addressed in 1989, and then updated in 2001, by the comprehensive Emerald Necklace Parks Master Plan (the Master Plan). More than 52 improvements aimed at rehabilitating and preserving the Emerald Neckiace are grouped under the Master Plan, which is organized in four phases:

> ***"This effort (to rehabilitate the Muddy River) will be a national model … the beginning of a great public sector project that will encourage private sector efforts."***
>
> ***- Robert Durand, State Secretary of Environmental Affairs, February 24, 1999***

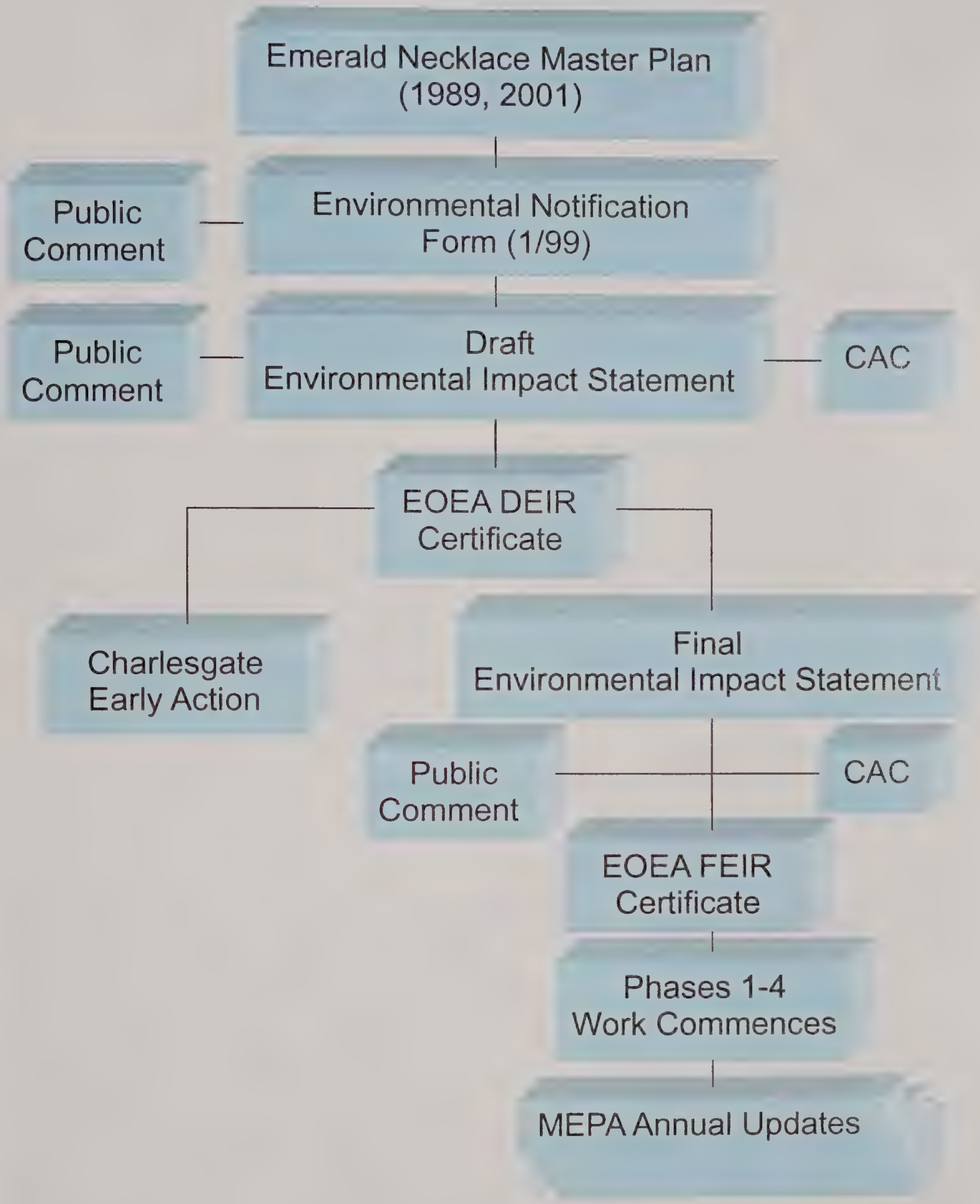
- Phase I: Dredging, flood control, water quality improvements, aquatic/riparian habitat enhancement, historic restoration, and best management practices within the Muddy River area (the Back Bay Fens, Riverway, and Olmsted Park and its waterways).

- Phase II: Historic landscape improvements, revegetation, major traffic and pedestrian circulation improvements, major building and vehicular bridge restoration (also within the Muddy River area).

- Phase III: Minor traffic circulation improvements, small building and pedestrian bridge restoration (also within the Muddy River area).

- Phase IV: Park and water body improvements in the remaining areas of the Emerald Necklace (i.e., Jamaica Park, Arnold Arboretum, and Franklin Park/ Scarboro Pond).

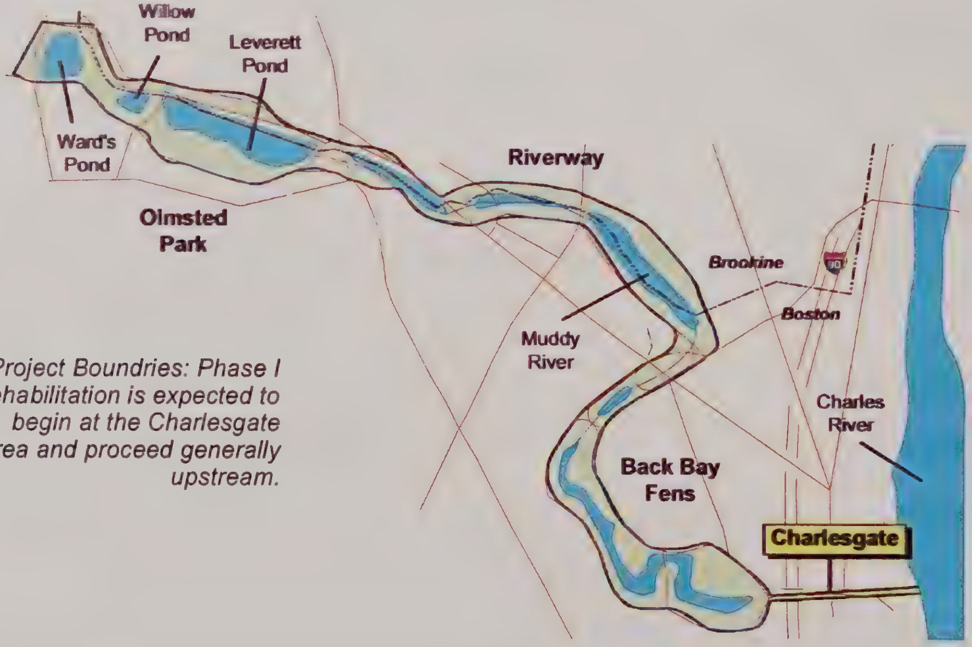
Emerald Necklace Master Plan MEPA Process


Emerald Necklace Master Plan (1989, 2001)
Public Comment
Environmental Notification Form (1/99)
Public Comment
Draft Environmental Impact Statement
CAC
EOEA DEIR Certificate
Charlesgate Early Action
Final Environmental Impact Statement
Public Comment
CAC
EOEA FEIR Certificate
Phases 1-4 Work Commences
MEPA Annual Updates

Due to the project's scope and size, the Massachusetts Environmental Policy Act (MEPA) governs environmental review. Pursuant to MEPA, an Environmental Notification Form (ENF) was submitted to the Secretary of Environmental Affairs in April 1999. The Secretary then issued two certificates, one for the Environmental Impact Report's (EIR) scope and requirements, the other establishing an area-wide special review process, which includes these elements:

- A Draft EIR (DEIR) and Final EIR (FEIR).
- An opportunity for activities in the Charlesgate and Leverett Pond (sand bar) areas (see below) to proceed following MEPA review and DEIR certification.
- Annual filing and public review of project updates after the FEIR is completed.
- Designation of a Citizen's Advisory Committee (CAC) – Which will assist in evaluating the project's efforts to reach its goals, while minimizing impacts to the environment.

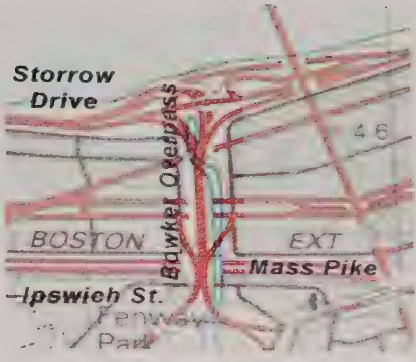
This DEIR focuses on the Master Plan's Phase 1 and further divides Phase I into three areas – Charlesgate, Leverett Pond (sand bar), and Muddy River. The entire project area begins with the Muddy River confluence with the Charles River and extends 3.5 miles upstream through the Back Bay Fens, the Riverway, Olmsted Park, and into Ward's Pond. Charlesgate covers the area between Boylston Street and the Charles River, and Leverett Pond is part of Olmsted Park (see Figure ES-1). In general, work would likely proceed geographically from the Muddy River confluence to Ward's Pond upon FEIR approval; however, work in the Charlesgate area may begin subsequent to review and certification of this DEIR.



Project Boundries: Phase I rehabilitation is expected to begin at the Charlesgate area and proceed generally upstream.

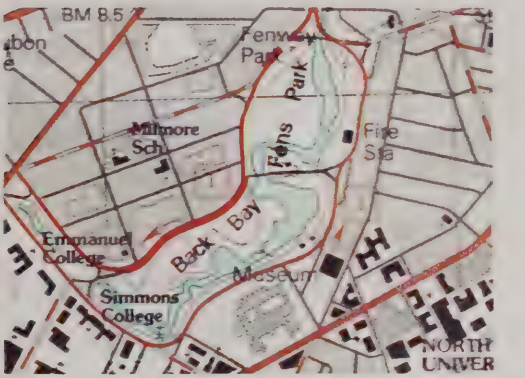
The above shows the study area; a brief description of each Phase I project area follows. Detailed information is provided in Section 4.0 of this DEIR.

Charlesgate



The Charlesgate project area.

The Charlesgate area, the last portion of the Muddy River before it empties into the Charles River, is a Metropolitan District Commission (MDC) property located entirely within Boston. The project area includes parkland extending from the Richardson Bridge (Boylston Street) to the Charles River. Several major roadways are within the project area as well; the elevated Bowker Interchange, Commonwealth Avenue, Beacon Street, Bolyston Street, local streets with connections to Storrow Drive, the Massachusetts Turnpike, Ipswich Street, and the CSX railroad. Land use is mostly residential; the Massachusetts Bay Transportation Authority (MBTA) provides mass-transit via bus, subway, and rail service through the area.



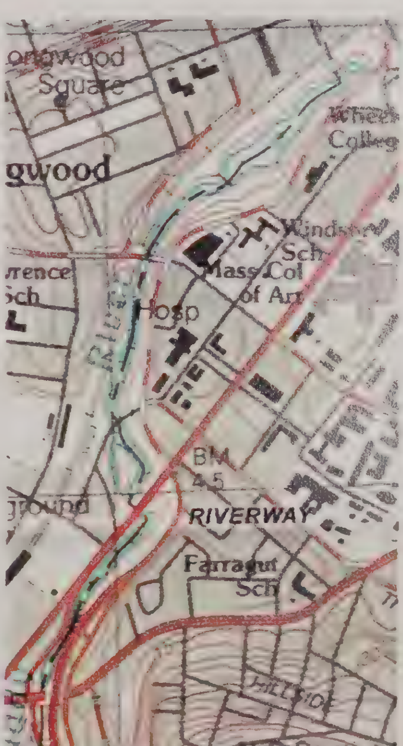
The Back Bay Fens project area.

Back Bay Fens

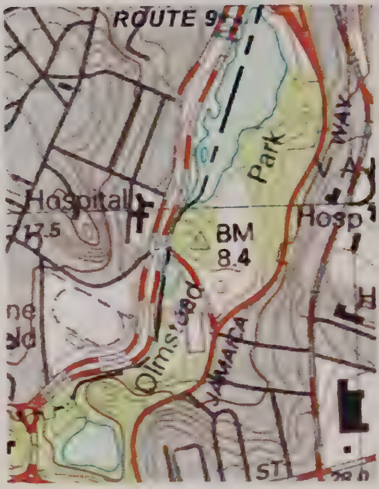
The Back Bay Fens area includes parkland that extends southerly (upstream) along the Muddy River from Bolyston Street at the Richardson Bridge to the new Landmark Center (formerly the Sears Building), several intersecting roadways, and the parallel roadways of Park Drive and The Fenway. The area is scattered with historical monuments(e.g. TheWar Memorial, Curley Rose Garden), cultural institutions (e.g., the Museum of Fine Arts, Gardner Museum), and an impressive number of colleges and universities (e.g., Simmons, Emmanuel, and Northeastern). Fenway Park and Kenmore Square are also nearby.

The Riverway

The Riverway begins at the twin six-foot culverts under the Riverway Parkway at the Sears Rotary. The MDC-maintained Riverway parkway runs parallel to the Muddy River's east side with the MBTA Green Line tracks running along the west side. Three islands, all deisgned by Olmsted, are part of The Riverway area. One island, located between Brookline Avenue and Netherlands Road, is maintained as a park and accessible to pedestrians by stairs and bridges; the other two islands are neither maintained nor accessible. Wheelock College and the Longwood Medical area are located adjacent to The Riverway's boundaries.



The Riverway project area.



The Olmsted Park project area.

Olmsted Park and its Waterways

Olmsted Park includes three ponds: Leverett, Willow, and Ward's. Leverett Pond has three islands along its western edge and also contains a large sand bar from the largest stormwater outfall into the Muddy River—the Village Brook Drain. Major roadways around the ponds include Route 9, The Jamaicaway, Willow Pond Road, and Pond Avenue. Beyond the park's boundaries are several residential neighborhoods and the Brook House. The U.S. Veterans Administration Hospital, and the Museum of Native Americans are nearby.

Problems in the Emerald Necklace

Preserving the Beauty

Created nearly 100 years ago, the Emerald Necklace in general, and the area surrounding the Muddy River in particular, have experienced extensive urbanization. As the populations of Boston and Brookline grew, they brought with them the attendant expansion of buildings, roadways, traffic, and congestion—all of which have adversely affected the watershed.

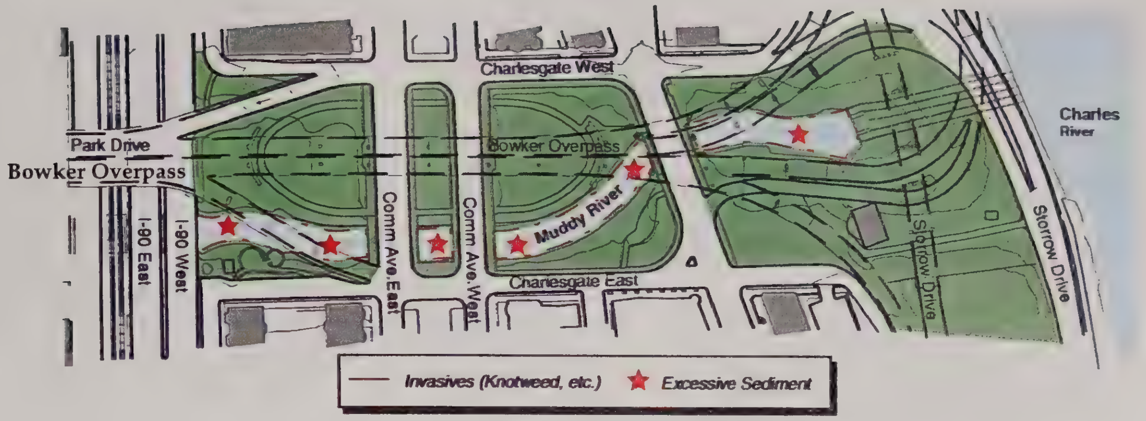
- Flooding has worsened because there is little natural storage left in the widely paved watershed, and sediment and debris have washed into the river constricting flood-carrying capacity.
- Water quality has deteriorated as an array of natural and man-made compounds are carried off the land surface during rainstorms and deposited into the river and accumulated in the sediment.
- Non-native invasive species of flora such as *Phragmites,* knotweed, and buckthorn have overtaken portions of the river, pushing out native species, creating safety hazards, eliminating natural habitats, and greatly limiting the diversity of wildlife that can live within the watershed.

As a result, Olmsted's distinctive landscape has declined in richness and diversity.

Following is a brief description of each study areas' physical features, biological environment, and historic significance. Extensive detail is provided in Section 4 of this DEIR, "Existing Conditions."

Charlesgate

Physical Features — The Muddy River channel in this area, generally about 40 to 50 feet wide and narrowing under seven bridges within its reach, consists entirely of stone and concrete construction with no wetland vegetation. The surrounding landscape is either grass or bare ground with some trees and shrubs, and scattered stands



Knotweed and excessive sediment are causing problems in the Charlesgate area.

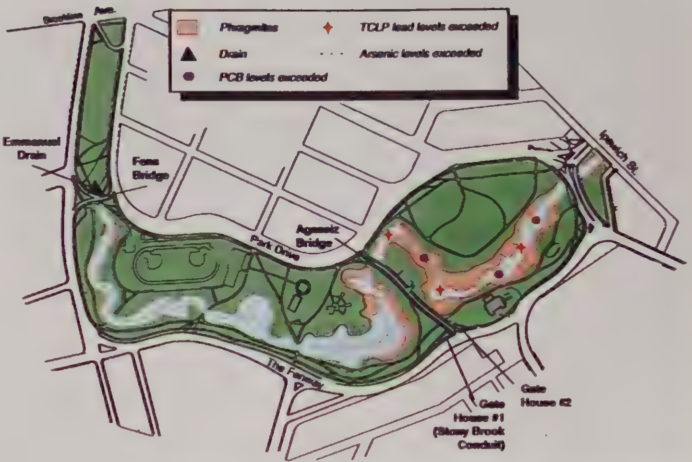
of Japanese knotweed. The normal water surface elevation during dry weather approximates the Charles River's (about 8 feet); average flow during dry-weather is between 2 to 5 cubic feet per second (cfs). The Massachusetts Department of Environmental Protection (MA DEP) has classified the entire Muddy River watershed as "Class B" — waters that are swimmable and fishable. However, historical data show that Charlesgate experienced excessive nutrient conditions during 1974, 1986, and 1992. Charlesgate's sediment contains varying, but not excessive, concentrations of petroleum hydrocarbons, polynuclear aromatic hydrocarbons (PAHs), and heavy metals. However, the larger problem is the abundance of sediment in this area; too much sediment has reduced the river's flow capacity.

Biological Environment — Fanwort, duckweed, and filamentous algae (aquatic vegetation) are found throughout Charlesgate. Species-specific information on fish was not available for this area, but due to its proximity to the Back Bay Fens, it is probable that fish such as the Large Mouthed Bass, Pickerel, and Yellow Perch swim here as well. Several species of birds (e.g., the American Crow and Robin, Blue Jay, and Black-Capped Chickadee) and reptiles (e.g., the Common Musk Turtle and Red-Eared Slider) also inhabit the area.

Historic Significance — Olmsted designed the Charlesgate area, which he called the Beacon Street Entrance, between 1878-1895. His vegetative plan was extensive, but the majority of the plantings did not survive. Olmsted's Richardson iron railroad bridge, constructed in 1880, was razed in 1962 as part of a land taking by the Massachusetts Turnpike Authority (MTA); however, in the 1980s, the arches and historic balustrades were restored. The Bowker Overpass, which connects Storrow Drive to Park Drive was not part of Olmsted's original area plan: the MDC constructed the overpass in the mid-1960s. The Commonwealth Avenue Mall, part of Charlesgate, was designated a landmark by the City of Boston in 1978. The entire Charlesgate area is included on the National Register of Historic Places as part of the Back Bay District.

The Emerald Necklace parks still serve "meeting grounds," just as Olmsted intended.

Back Bay Fens



Problems in the Back Bay Fens include excessive concentrations of arsenic, lead and PCBs in addition to dense Phragmites

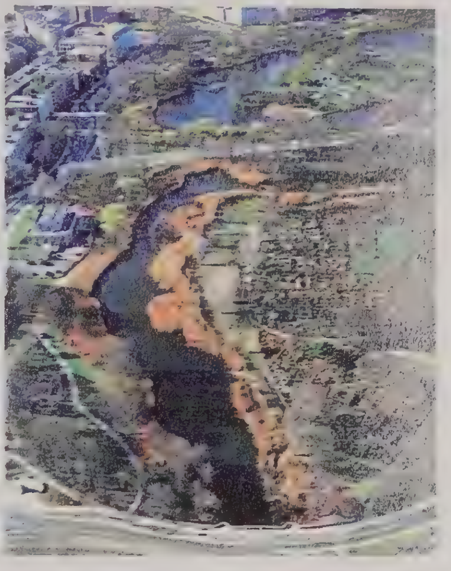
Physical Features **—** Like the Charlesgate area, the Back Bay Fens is located entirely within the City of Boston. The Fens is bordered on both sides by grassed parkland accessible by paved and unpaved paths, making it a popular recreational area. Extremely dense and large stands of the giant reedgrass (*Phragmites australis*) grow along much of the Muddy River's bank in the Fens, severely constricting flood-flow capacity. Numerous small stormwater outfalls are sprinkled throughout the Fens; large outfalls include overflow from the Stony Brook Conduit at Boston Gate House No. 1 and the Emmanuel Drain. Channel widths in the Fens range from 50 to 200 feet. Like Charlesgate, normal water surface during dry-weather is approximately 8 feet, and the average flow during dry-weather is between 2 to 5 cfs. Unlike Charlesgate, the Fens experienced severe flooding during the October 1996 storm, when peak flow in the upstream end reached about 520 cfs, and downstream about 1,030 cfs. Although deemed swimmable and fishable by MA DEP, water quality tests conducted in December 2000 showed excessive levels of fecal coliform bacteria. Sediment borings taken summer 2000 contained elevated levels of lead (between Agassiz Road and Ipswich Street), arsenic (between the Emmanuel Drain and Gate House No. 1), and polychlorinated biphenyls (PCBs) (between Gate House No. 1 and Ipswich Street).

Flooding has been a major problem in recent years in the Muddy River.

Biological Environment — A maintained parkland, the Fens is beautified by approximately 1,500 trees (flowering, canopy, heritage, and evergreen) and more than 26,000 square feet of shrubs. Unfortunately, some of that beauty is masked by invasive plant colonies, such as *Phragmites*, that occupy more than 380,000 square feet, screening park vistas from bridges and constricting the Muddy River's flow and storage capacity. PCBs have damaged the fish population, which includes the Large Mouthed Bass, Yellow Perch, American Eel, Goldfish, and Common Carp. In 1990, the Massachusetts Division of Fisheries and Wildlife issued a Public Health Advisory after finding PCBs in edible fish tissue. More than a dozen different species of birds (e.g., the Red-Winged Blackbird, Mallard, and European Starling) and two types of reptiles (i.e., Common Musk Turtle and Red-Eared Slider) inhabit the Fens, as do several wetland plants (e.g., Red Maple, Cattails, Glossy Arrowwood).

Thousands of flowering trees and shrubs adorn the Back Bay Fens.

Historic Significance — Olmsted designed and constructed the Fens between 1878-1895. His intent for the Fens was to create the feeling of a restored natural tidal marsh with a system of drives, walks, and boating launches, while at the same time solving some sanitary engineering problems. By designing extensive low islands planted with sedge, Olmsted wanted to "prevent development of surf that would undercut the banks during high winds and heavy rains ... the narrow, curving waterway, in addition to providing landscape interest, provided no place where storm winds could build up heavy surf" (from Olmsted's 1886 "Paper on the Back Bay Problem and Its Solution"). The Fens was redesigned by Arthur Shurtleff between 1910-1933, when recreational facilities, ornamental gardening (the James Michael Curley Rose Garden), and non-recreational facilities (the Fire Control Center) were built. Active sports replaced the quieter uses Olmsted had intended. More changes were on the horizon: war memorials were added in 1940 and in the 1940s and 1950s parkland was taken for road-widening, and portions of the river were replaced with culverts and filled to configure new roads. In 1971, the Fens was added to the National Register of Historic Places; in 1983, the City of Boston designated it a landmark.

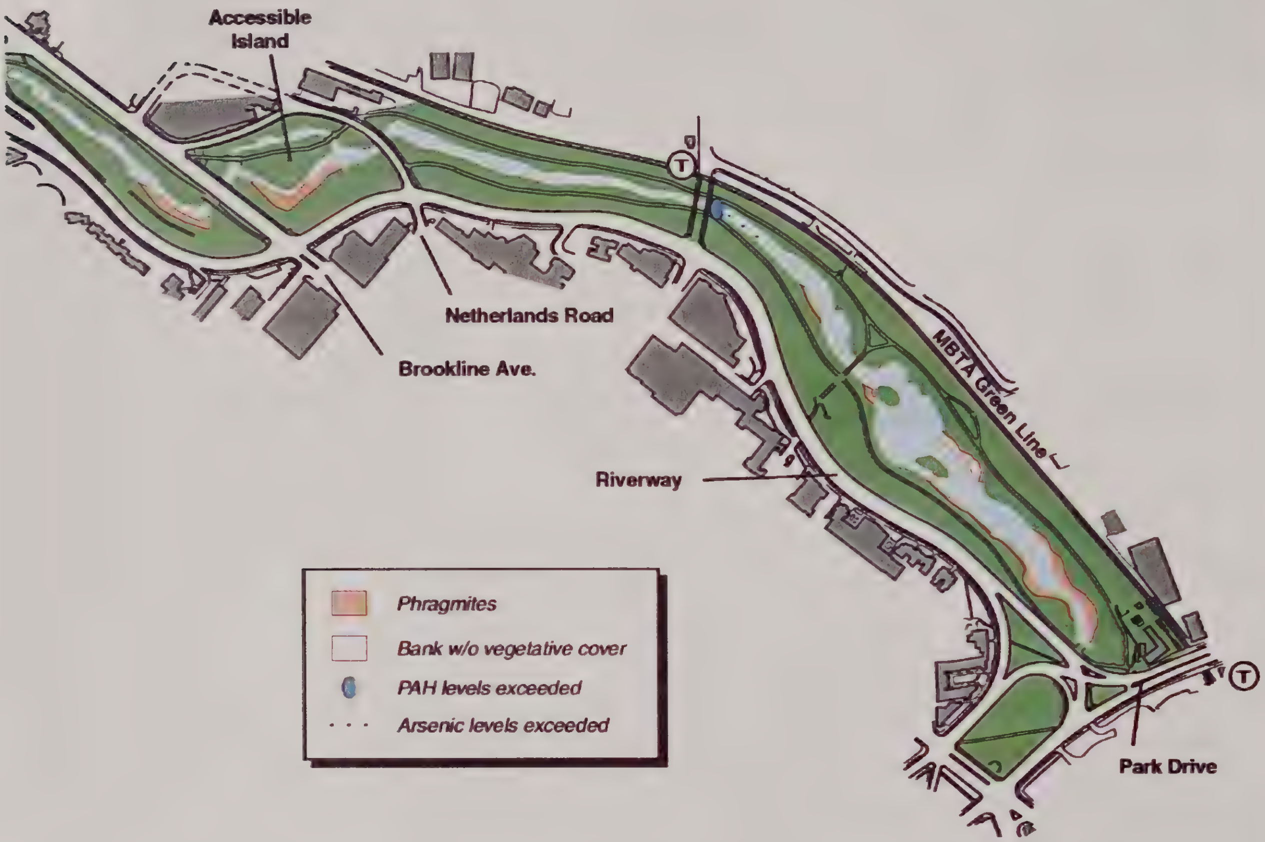


Phragmites, the beige areas along the banks, are literally choking the River — severely constricting flow and flood storage capacity

The Riverway

Physical Features — With the Muddy River transversing the line between Boston and Brookline, The Riverway is a parkway and grassed parkland with numerous paralleling and intersecting streets. All but two sections of The Riverway are naturalized terrain designed by Olmsted. In the area of the former Sears parking lot, the river remains in twin 6 foot diameter pipes below ground. Several bank areas are without vegetative cover and must be stabilized to avoid further erosion by stormwater runoff and river flow. River widths in this area range from 30 to 150 feet. Like the Back Bay Fens and Charlesgate, flows during dry-weather are around 2 to 3 cfs and the elevation is about 8 feet. Significant flooding occurred in the Riverway during the October 1996 storm, with peak elevation reaching almost 19 cfs. Because of the high river waters, floodwaters from local drainage systems tributary to the Muddy River could not discharge; as a result, local neighborhoods were flooded and the Kenmore MBTA station was inundated with 30 million gallons of water. Water quality has also been a problem: past testing has indicated that the bacteriological water quality standard was not met in 1974, 1986, 1992, and 1998, and that the

Riverway experienced excessive nutrient conditions in 1992, 1995, and 1998. In October and December 2000, fecal coliform bacteria failed to meet water quality standards, especially during wet-weather conditions, at several sampling locations. And while no detectable levels of PCBs were found in its sediment, arsenic and PAHs concentrations were above the MA DEP landfill reuse levels.



Biological Environment – The area surrounding The Riverway is an urban park with mature trees, grass, and some shrub. With more than 900 trees, 270,000 square feet of woodland, and 20,000 square feet of shrubs, the area should be a verdant paradise; however, the parkland has been invaded by about 270,000 square feet of *Phragmites* and knotweed. In the river, dense growth of *Phragmites* has blocked the flow channel at the Island Area (between Brookline Avenue and Netherlands Road) and has severely narrowed the flow channel at other locations, particularly upstream of the two six-foot culverts at Park Drive and The Riverway intersection. Erosion is also a problem: bare lawns, wash outs of storm sewers, and overuse compaction have contributed greatly to the land's demise. Several fish species, such as the Red Fin Pickerel, Brown/Yellow Bullhead, and Pumpkinseed swim the Riverway's waters; but PCBs were found in their edible tissue in 1990, and the Public Health Advisory issued then is still in effect. More than a dozen species of birds, including the Black and White Warbler, Downy Woodpecker, and Mourning Dove, inhabit the parkland, along with five species of wetland plants (e.g., the Speckled Adler and Purple Loosestrife) that are being choked by the giant reed grass (*Phragmites australis*) and knotweed.

The Riverway

Historic Significance – Olmsted designed and constructed The Riverway from 1880-1895. Here, Olmsted's intent was to create a landscape with the character of a New England fresh-water stream. In 1904, John Charles Olmsted, described the accomplishment as "a beautiful and popular water park [that] represents the transformation of what was once an ugly, neglected, unsanitary stream." Due to its narrowness and terrain, The Riverway was not suited to active recreation fields and organized sports and, therefore, escaped the massive redesigns that occurred in the Fens. However, the roadways in this area were not as fortunate. Major changes—such as the Route 9 overpass, rotaries, road widening, right-hand lane turns, exit and entry ramps, and parking lots—were constructed between 1936 and 1959. The Riverway was placed on the National Register of Historic Places in 1971, and designated a City of Boston landmark in 1989.

Olmsted Park and its Waterways

Olmsted Park includes three ponds: Leverett, Willow, and Ward's Ponds. The physical features around the each pond are somewhat varied (e.g. grassed parklandand woodlands along the perimeters, surrounded by roadways such as Route 9 and the Jamaicaway). The biological environments are more similar in that they contain the same types of fish, wildlife, and wetlands. Only distinctions are noted below (for more detail, see Section 4 of this DEIR).

Physical Features

- *Leverett Pond* includes three islands on its western side and has a large sand bar from the largest stormwater outfall into the Muddy River—the Village Brook Drain. Another drain, the Daisy Field Drain, also contributes stormwater flows. Peak elevation during the October 1996 storm was about 19 feet, 11 feet higher than normal. Water quality standards were not met in 1986, 1992, 1995, and 1998, and excessive nutrient conditions occurred in 1992, 1995, and 1998. While fecal coliform bacteria concentrations were very low/not detected in the Village Brook Drain in October and December 2000, testing showed high levels during wet- and dry-weather conditions in the Daisy Field Drain. Elevated concentrations of pesticides, arsenic, and PAHs were found in the pond's sediment in summer 2000.

- *Willow Pond* is currently filled with sediment; resultant vegetative sand bars are visible above the water surface. Stormwater is contributed via the Chestnut Street Drain and from upstream discharge from Ward's Pond. Some flooding occurred in Willow Pond during the October 1996 storm. As in Leverett Pond, water quality standards for fecal coliform have not been met historically and exceeded the limits in autumn/winter 2000 as well. PAHs and lead also were found at elevated levels in Willow Pond's sediment.

Spring Pond (Natural History Pool) a unique habitat, where the rare Three-Spine Stickleback has been found.

- *Ward's Pond* is a kettle hole pond with a depth of about 4 feet and very steep slopes around its perimeter. It receives its flow contribution from Jamaica Pond, but was not flooded during the October 1996 storm. Water quality standards have been met historically, so no testing was conducted in late 2000. Only one sediment sample exceeded the TCLP lead regulatory limit.

Biological Environment

- Like all other parts of the Emerald Necklace, much of the beauty of *Leverett Pond* is marred by invasive plant colonies, such as knotweed (nearly 96,000 square feet). The same kinds of fish (e.g., Large Mouthed Bass), birds (e.g., American Crow), and wetland plants (e.g., Purple Loosestrife) that inhabit other Muddy River areas live in Leverett Pond as well.

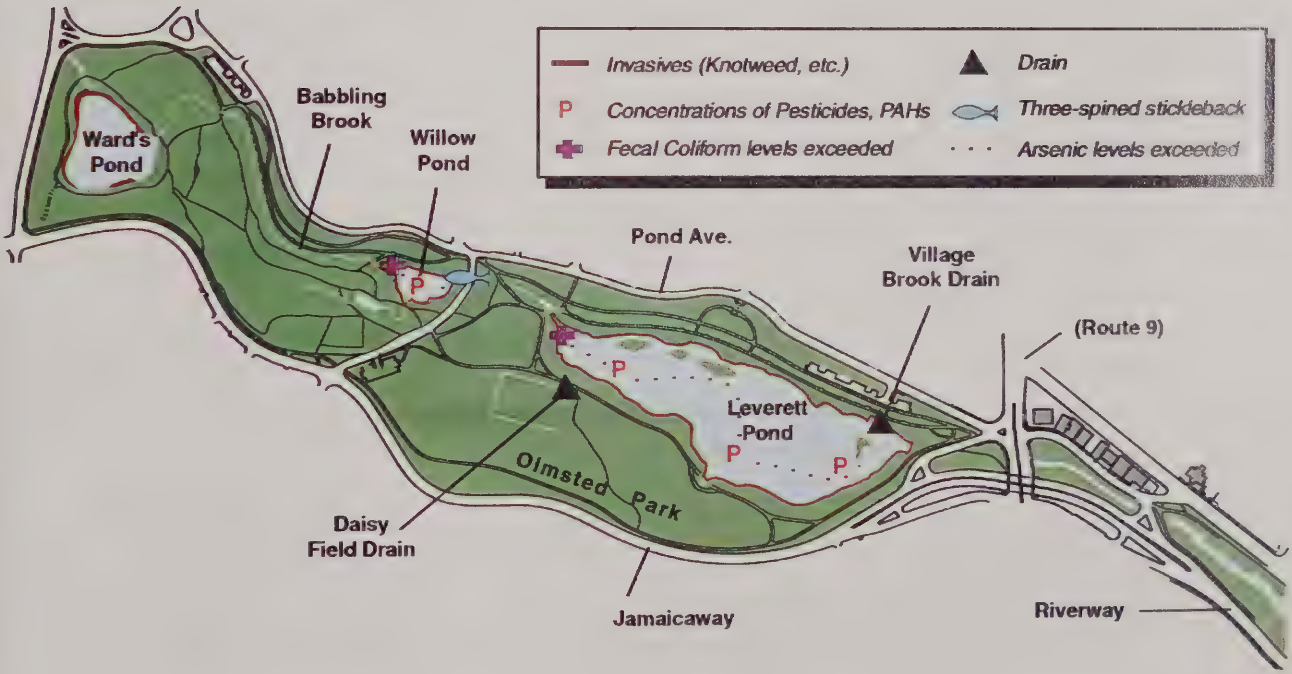
- *Willow Pond's* surrounding area includes over 220,000 square feet of woodlands and nearly 30,000 square feet of invasive plant colonies, such as buckthorn and knotweed. A rare species of fish – the three-spined stickleback – was found to inhabit a small pool in Willow Pond.

- Existing vegetation at *Ward's Pond* consists of approximately 160 trees, 850 shrubs, nearly 200,000 square feet of woodland, and more than 20,000 square feet of invasive plant colonies (e.g., knotweed). With the exception of an exotic turtle, the same species of fish, birds, reptiles, and wetland plants that live in the other ponds also inhabit Ward's Pond.

Historic Significance

Olmsted's intent for the area now known as Olmsted Park (designed and constructed between 1880-1895) was a "chain of picturesque fresh-water ponds, alternating with attractive natural groves" (from *Suggestion for the Improvement of Muddy River*, 1880). The Park (including the three ponds) was placed on the National Register of Historic Places in 1971, and designated a City of Boston landmark in 1989.

- *Leverett Pond* already existed in 1880. With Olmsted's creation of a park, the boundary between Boston and Brookline changed and several pathways were constructed for access. In the 1940s, the Boston Park Department built a baseball diamond in the meadow east of Leverett Pond (now known as Daisy Field).
- At the time of Olmsted's design, both *Willow Pond* and *Ward's Pond* were small water bodies. Willow Pond had a small brook feeding it and a small brook outletting to Leverett Pond; Ward's Pond was fed by Jamaica Pond and connected to Willow via Babbling Brook. As with the other Muddy River parks, Olmsted designed extensive plantings to beautify the sites, and pathways and bridges to provide access to them. In 1956, MDC widened a right-of-way around Willow Pond parkland and, in 1962-63, constructed a skating rink on a parcel of land just east of the pond (the rink was removed and the area resodded in 1997). In 1967, MDC planned to take more land by eminent domain and completely reconstruct the roadways surrounding Willow Pond and Spring Ponds. Opposed to the plans, the Town of Brookline retained ownership via a successful court battle, and the parkways were not disturbed. Ward's Pond has not been modified since the late 1890s, when pools around the pond were filled and boulder bridges demolished.



Solving the Problems

It's clear from the above summary and from the detail provided in this DEIR's Section 4 that problems abound in the Emerald Necklace. In order to preserve this national and local historic landmark and rehabilitate Olmsted's landscape, the Emerald Necklace Master Plan was developed. This project will address Phase I of the Plan by accomplishing five objectives:

- Improve flood control — reduce flooding of the residences, institutions and businesses in major storms by reducing flood elevation in the river.

- Improve water quality — reduce the level of contaminants in the river while increasing the dissolved oxygen.

- Enhance the aquatic and riparian habitat — improve the quality and diversity of aquatic and wildlife habitat in the river and along the banks.

- Restore the landscape and historic resources — implement elements of the Master Plan along the river corridor.

- Institute Best Management Practices (BMPs) — to obtain these objectives:
    - minimize re-sedimentation rates by capturing more sediment before it reaches the river, ensuring major dredging will not be required again for nearly 70 years.
    - improve water quality by reducing the volume, bacteria, nutrients, and other contaminants entering the river as runoff.
    - maintain and protect the public's investment by improved maintenance in the watershed.
    - contribute to the attainment of fishable/swimmable conditions in the Charles River, which receives the Muddy River's flow, by achieving the above objectives.

Selecting the Right Strategy to Achieve Project Objectives

A variety of alternatives were evaluated that addressed one or more project objectives. Because the project's objectives are interrelated, one alternative may advance several objectives simultaneously. Alternatives were screened by comparing the relative benefits against each other. Only alternatives that met the project objective(s) and were judged more technically suitable, environmentally advantageous, consistent with historic preservation goals and cost-efficient were selected.

Determining What Will Work

A comprehensive evaluation of dozens of alternatives has ensured that the right measures will be taken. A flow diagram of the alternatives screening process summarizes all alternatives and the criteria against which they were evaluated, shows why some were rejected and others accepted, and explains the geographical area in which they will be most useful (e.g., Back Bay Fens, The Riverway, etc.).

The Preferred Plan

Several actions judged to be technically suitable, environmentally sensitive, and cost-efficient will rehabilitate the Emerald Necklace—from dredging and infrastructure improvements to historic reconfigurations and habitat improvements to source control and treatment improvements. The preferred plan for each geographical area is outlined below and further detailed in Section 5 of this DEIR. Also, included below, is a discussion of "basin-wide" BMPs, since these practices are recommended throughout the Emerald Necklace.

Preferred Alternative for Charlesgate

- Construct one staging area for dredging equipment.
- Dredge and remove 3,300 cubic yards of sediment and debris.
- Replant vegetation selected from Olmsted list.
- Rehabilitate staging areas and disturbed areas.
- Replace new pathways and lights.
- Remove waterway obstructions under Ipswich Street.

Charlesgate Area (Boylston Street to the Charles River)

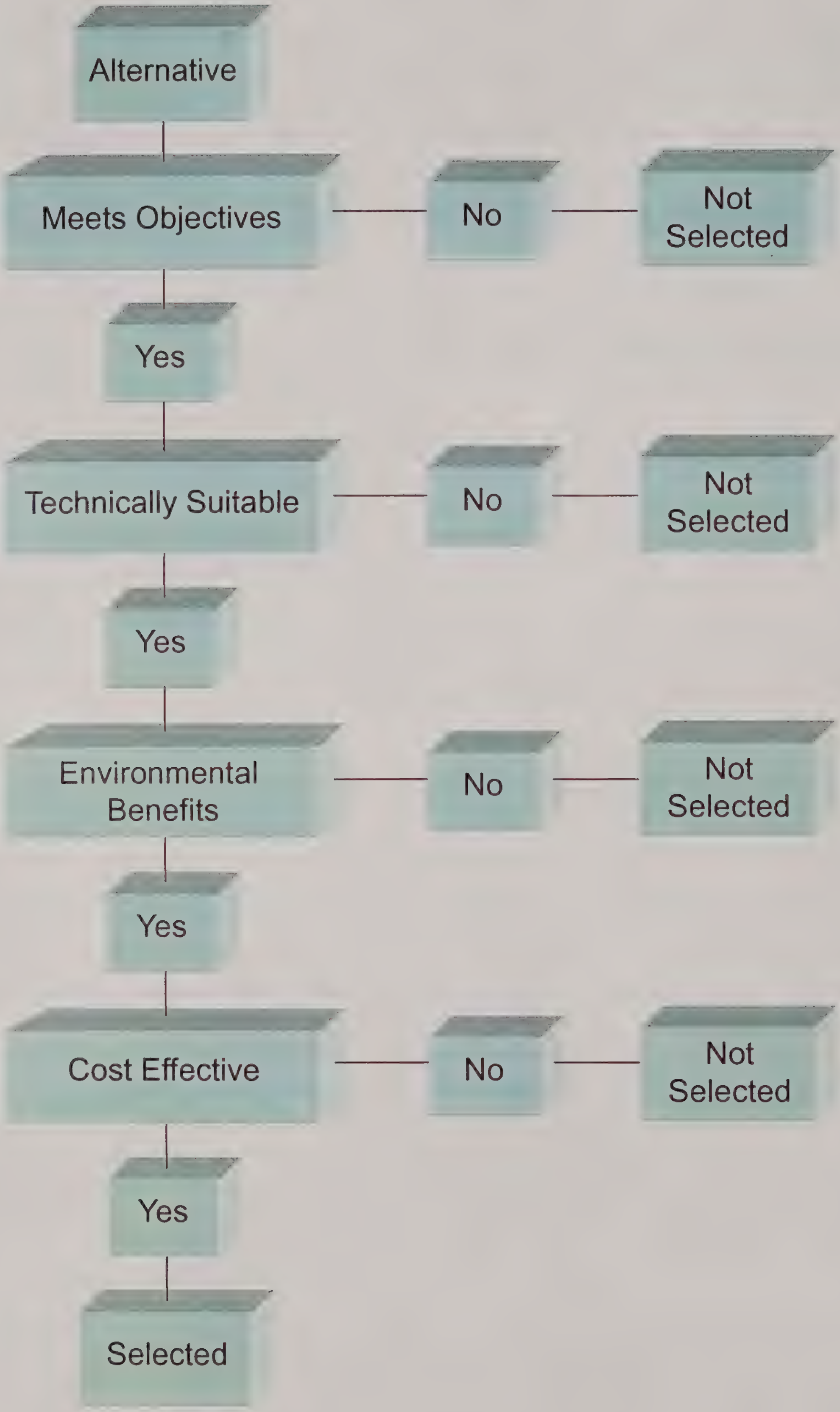
Dredging will remove approximately 3,300 cubic yards of sediment in the Charlesgate area. A staging area will be set up at Commonwealth Avenue. Trucks accessing the staging area from I-93 will follow Massachusetts Ave. to Beacon St. to Charlesgate West. Trucks leaving the area will follow Commonwealth Ave. to Massachusetts Ave. to I-93. Construction in the Charlesgate area will not require temporary closure of roads or sidewalks. The Gate, Gatehouse, and balustrade areas will be protected.

Back Bay Fens (The Riverway at the former Sears Parking Lot to Boylston St.)

Bank-to-bank dredging will include the removal of dense stands of *Phragmites*. After dredging is completed, construction of culverts and daylighting will follow. Daylighting will restore the open waterway of Olmsted's time at the former Sears parking lot and upstream at the Fens Bridge. Three construction staging areas will be set-up at Agassiz Road, the Lagoon (Jersey Street) and Fens Bridge. The construction access route for trucks coming from I-93 (Exit 18) would be via Melnea Cass Boulevard, Tremont Street, Ruggles Street, Louis Prang Street, The Fenway, Park Drive and Boylston Street. The egress route for the Lagoon and Fens staging areas is the reverse of the access route. For the Agassiz Road staging area, egress would be to Westland Avenue to Mass. Ave. to I-93. For culvert construction at The Riverway, one lane closure of The Riverway is possible providing that signal-time adjustments are made. Culvert construction across Brookline Avenue at the Sears Rotary will require a combination of night and day work using construction techniques to minimize noise generation.

Almost all the selected alternatives address several objectives at once, ensuring not only that the main issue of flood control is resolved, but also that the project is cost-efficient and environmentally and historically compatible.

After the invasives are removed, landscape rehabilitation will include both plant massing and the construction of turf-covered banks. Since the Fens is now freshwater, plant lists for the Muddy River will be used and plant massings from the historic plan documentation will guide the rehabilitation of disturbed areas. The daylighted areas will be restored and rehabilitated to reflect Olmsted's original plan.



Alternative Screening Process

Preferred Alternative for The Back Bay Fens

- Construct three staging areas for sediment dewatering equipment and truck loading at Agassiz Road, adjacent to the Lagoon (Jersey Street) and Louis Pasteur.
- Dredge and remove 96,500 cubic yards of sediment and debris.
- Daylight culverts at Fens Bridge and former Sears parking lot to Olmsted-designed shoreline configuration to the extent possible.
- Prevent future encroachment and preserve the historic shoreline by removing 23,500 cubic yards of *Phragmites*.
- Revegetate staging areas and disturbed areas using plants selected from Olmsted list to enhance habitat values.
- Construct a new 10-ft by 16-ft arch culvert under The Riverway at former Sears parking lot. Maintain the twin 72-inch diameter pipes under The Riverway.
- Construct a new 10-ft by 24-ft arch culvert under Brookline Avenue at the Sears Rotary with an overflow to the Muddy River Conduit.
- Rebuild the upstream and downstream headwalls of the Fens Bridge to historic rehabilitation standards and remove sediment from the Fens Bridge culvert.
- Create sedimentation basins by over-dredging in four locations: Sears culvert, downstream of Louis Pasteur Bridge, at the Victory Gardens, and downstream of Agassiz Road.
- Decrease the use of pesticides and herbicides in the Victory Gardens by developing a public education program on water quality impacts and alternative methods of weed and pest control.
- Create a vegetated swale near the Victory Gardens to reduce overland flow velocities and trap pollutants.
- Reconstruct curbs, gutters and storm drain systems primarily along roadways in the Fens, the Fenway, and Agassiz Road to minimize overflows onto parkland.
- Install a particle separator the end of the Emmanuel College drain. Complete design and construction by 2007.
- Evaluate possible sites for other particle separators based on the pilot study for water quality improvements.

The Riverway (The Riverway at the former Sears Parking Lot to Leverett Pond)

The Riverway will be dredged bank-to-bank and invasive plants such as *Phragmites* will be excavated. A staging area will be set-up at Netherlands Road. During construction, Netherlands Road will be closed to general traffic which would be diverted to The Riverway and Brookline Avenue. Access to the staging area would be from Route 9 to Brookline Avenue to Aspinwall Avenue to Netherlands Road. Egress would be to a short length of The Riverway to Brookline Avenue to Route 9.

Preferred Alternative for The Riverway

- Dredge 20,200 cubic yards of sediment and debris.
- Remove 10,000 cubic yards of invasive species and restore the bank.
- Revegetate staging and disturbed areas with historically based plantings and wetland species.
- Create sedimentation basins by over-dredging in two locations: Netherlands Road and upstream of Brookline Avenue.
- Reconstructing curbs and gutters and the storm drain system, to prevent bank erosion along The Riverway.
- Construct one staging area at Netherlands Road for sediment dewatering equipment and truck loading.

After dredging, the original shoreline and grading will be restored to Olmsted's original plan. Areas where invasives have been removed and where banks are unstable will be rehabilitated with historically based plant massing and turf-covered banks. Two inaccessible islands near the Longwood MBTA Station will remain inaccessible as work proceeds. The existing reachable island and two bridges near Netherlands Road will remain usable. Planting will include wetland planting, bank planting, and upland planting of shrub and tree layers to improve wildlife habitat and restore the historic intent of the landscape.

Leverett Pond

Leverett Pond will be dredged bank-to-bank. A staging area will be set-up at Daisy Field using the northern softball field. The Little League field will be separated from the staging area with fencing and remain in use. Construction vehicle access to the staging area would be from Route 9 to Cypress Street to Pond Avenue to Willow Pond Road. The egress route would be the reverse of the access route. Construction will not require any temporary closure of roads, and walkways will be temporarily relocated around construction zones.

Restoration of the historic turf-covered banks on the northeast side of the pond will require restoration of an historic path to re-establish pedestrian access. Areas where invasives have been removed will be rehabilitated with plant massing and turf-covered banks. The Brookline shoreline has gabions, which will be protected and replanted with wetlands species. Three existing inaccessible islands in Olmsted Park will remain inaccessible. Invasive species will be removed from the islands. One island will be reshaped to reflect Olmsted's original plan.

Preferred Alternative for Leverett Pond

- Construct one staging area at Daisy Field for sediment dewatering equipment and truck loading.
- Dredge 23,900 cubic yards of sediment and debris including sand bar opposite Village Brook drain.
- Re-vegetate staging and disturbed areas using plants selected from Olmsted list.
- Rehabilitate historic island and shoreline stabilization where needed.
- Restore Babbling Brook at the inlet from Willow Pond.
- Create a sedimentation basin by over-dredging Leverett Pond near the Village Brook Drain.
- Re-orient the Daisy Field backstop and ball field.
- Evaluate the effectiveness of the particle separator at the Daisy Field outfall.
- Evaluate the feasibility of storm drain treatment devices (i.e., off-line underground sand filters, dry swales, etc.) in the Village Brook watershed.

Willow Pond

After dredging, the original Willow Pond shoreline and grading will be restored to Olmsted's original plan. Dredging Ward's Pond will require piping to be laid on the path above the brook between Ward's and Willow Ponds. Once this piping is removed, rehabilitation of the Willow Pond shoreline will include restoring the culvert bridge with pudding stone "teeth" and the rock bank from Spring Pond into Willow Pond. Planting will include wetland planting, bank planting, and upland planting of shrub and tree layers to improve wildlife habitat and restore the historic designed landscape.

Preferred Alternative for Willow Pond

- Use Daisy Field staging area.
- Dredge 5,900 cubic yards of sediment and debris.
- Re-vegetate disturbed areas using plants selected from Olmsted list and stabilize historic shoreline.
- Enhance the habitat of the three-spined Stickleback.
- Repair the rock dam between Spring Pond and Willow Pond.
- Reintroduce and reshape one island.
- Create a sedimentation basin by over-dredging Willow Pond.
- Evaluate the effectiveness of a particle separator in the Chestnut Street drain.

Preferred Alternative for Ward's Pond

- Use Daisy Field staging area.
- Dredge 15,600 cubic yards of sediment and debris.
- Re-vegetate disturbed areas using plants selected from Olmsted list.

Ward's Pond

After dredging, grading at the outlet will be restored to Olmsted's original plan. Existing shorelines will be protected and maintained. Access into Ward's Pond will affect an existing historic bridge that will require protection. Planting will include wetland planting, bank planting, and upland planting of shrub and tree layers to improve wildlife habitat and restore the historic designed landscape where areas are disturbed. Turf-covered bank areas will be re-established and the footbridge over the outlet will be reconstructed.

Basin-wide BMPs

- Boston Public Works Department (PWD) and MDC need to evaluate and improve the effectiveness of their street sweeping programs.
- Boston Water & Sewer Commission (BWSC) is improving the tracking of catch basin sediment accumulation and adjust the frequency of cleaning accordingly through their Catch Basin Maintenance Program. Interim Progress reports have been submitted. Phase I has been completed.
- Boston Parks and Recreation Department (BPRD) and the Brookline Parks and Open Space Department (BPOSD) should address desire lines and maintain trails to prevent erosion.
- The project Proponents should jointly develop a public education program addressing issues such as litter control, clean-up after pets, and limiting the use of pesticides and herbicides.
- BPRD and BPOSD should develop a waterfowl control program and implement it. The plan should combine regulatory and actions and public education.
- Boston and Brookline should enhance their respective implementation of "pooper scooper" regulations.
- Project Proponents should conduct a pilot program on the several existing particle separators in the Muddy River watershed to determine the effectiveness of these devices.
- BPRD and BPOSD should maintain historic planting and turf area along shore line.

What Can Be Done to Mitigate Impacts?

The proposed rehabilitative construction will result in the temporary disturbance of the Muddy River, public use of portions of the parklands, roadways, and pedestrian walkways (see insert). Specifically, staging areas will contain some combination of sedimentation tanks, pumps, coagulant polymer feed systems, belt filter presses, water filters, conveyor belts for truck loading, a field office, and/or limited construction parking.The former Sears parking lot will further be the site of construction activities related to construction of an arch culvert under The Riverway and Brookline Avenue. Long-term physical alterations will occur at the Fens Bridge and former Sears parking lot, where culverted sections are restored to more natural ecosystems and historic configurations.

Mitigation of construction-related impacts will be implemented in two ways:

- Contract documents will include specifications on requirements that the contractor must meet to reduce environmental impacts.
- The contractor will prepare plans for approval on how work will be conducted to limit environmental impacts. These plans include, but are not limited to, the following:
  - *Dredging and Dredged Material Management* – describes in detail the dredging operations, disposal of materials, and the methods by which the contractor will control impacts of the dredging operations.
  - *Stormwater/Dewatering Pollution Prevention Plan* – describes the method to control runoff from the construction site and methods to prevent and control releases from the construction site.
  - *Water Quality Monitoring* – specifies how samples will be collected, analyzed, and reported; also includes how quality data will be used to modify operations if needed.
  - *Traffic Mitigation Plan* – describes traffic controls to meet specified truck routes and limit impact of the construction traffic on the surrounding areas; likely to include police details, traffic light adjustments, parking restrictions, and control of contractor traffic during high impact times.
  - *Rodent Control Plan* – specifies the use of certified pest control supervisors to control pests and rodents; includes cooperation with neighboring groups affected by the work.
  - *Historic and Natural Resources* – describes the protection of historic and natural resources, including, but not limited to, structures, trees, shrubs, and other areas outside the construction limits.

A Resident Engineer and an Independent Environmental Monitor (IEM) will monitor compliance with the contract documents and contractor's submitted plans. The IEM will be part of the Proponent's construction monitoring team, but not responsible for the construction contract's commercial terms. The IEM will report violations of the mitigation measures and environmental permits to the construction management team.

Sediment Quality

Muddy River sediment consists of organic silt, fine-to-coarse sand, and gravel. At various locations along the river the sediment also contains decayed plant matter, sticks, peat, bricks, wood, glass, and pieces of concrete. Contaminated sediments will be handled according to state and federal laws and regulations. Accumulated sediments will be removed to depths ranging from one to five feet. This removal will increase river flow capacity and improve overall sediment quality.

Water Quality

Construction activities will temporarily affect the Muddy River's water quality. Runoff from the staging areas, dredging operations, and return water from the belt filter presses will increase turbidity in the river. The duration will be short, and due to the extremely low flow volume of the Muddy River, the area affected will be limited. The return water will be treated so that it is expected to contain a total suspended solids (TSS) concentration of 50 milligrams per liter (mg/1) and a maximum daily limit of 100 mg/1.

Benthic Resources

Dredging will result in a temporary loss of benthic species (e.g. worms, midges and other invertibrates), which are presently dominated by pollution-tolerant organisms. Some remaining benthic species are expected to act as seed for regrowth. However, the new community is likely to be less dominated by pollution-tolerant organisms as clean water benthic species begin to proliferate.

Temporary Project Impacts

- Disturbance of park areas
- General environmental construction
- Traffic impacts
- Construction parking
- Increased turbidity
- Loss of fish
- Air quality
- Dust
- Loss of parking
- Public safety at staging areas
- Noise
- Odors
- Aesthetics

Fish Resources

It is anticipated that dredging will kill some fish. The fish loss may be proportionally higher in the bottom-dwelling species than the open-water species (the Muddy River would actually benefit from substantially fewer-bottom dwelling species). Because Spring Pond contains a rare fish species, the three-spine stickleback, no construction work will directly affect Spring Pond. The stickleback has also been found in a small pool in Willow Pond where the water from Spring Pond falls below a small stone dam. Sticklebacks in this pool will be relocated to Spring Pond, and the sediment in the pool removed; the pool will then be reconstructed with clean fill (after the stone dam has been repaired) and revegetated.

Wetlands

The proposed work includes the removal of *Phragmites*, including the extensive root system. Where one species dominates the present ecosystem, several species of shoreline and emergent plants will replace it. This will result in a substantial enhancement of the functions and values of the aquatic, wetlands, and upland ecosystems as well as a commensurate enhancement in wildlife functions and values. The proposed project will result in "no net loss" of wetland resources.

Wildlife Resources

In locations where dredging occurs during winter hibernation, amphibians and reptiles will not be able to relocate and will be lost. However, after construction, the upland wildlife community will benefit significantly from the revegetated landscape that will feature a diverse plant selection from the Olmsted plant list, selected to meet both preservation and habitat goals.

Ecological Functions and Values

Dredging, invasives removal, and disturbance of construction areas will temporarily impact the current habitat's function and values. Long-term physical alterations are related to bank stabilization, deepening of the water body, reconstruction of an island, and the enhancement of the aquatic and upland ecosystems to more natural ecosystems. The replacement vegetation will benefit waterfowl and avian species as a source of food and cover. In addition, much of the emergent vegetation will provide spawning areas for fish species.

Long term, the water quality is expected to improve due to BMPs and removal of significant quantities of dredged sediment, which is preventing the river from meeting Class B water quality criteria.

Pedestrian Access

Pedestrian access during construction will be obstructed in several areas, especially adjacent to staging areas. In most cases, access will be maintained with temporary pathways. Safety barriers and signage will direct pedestrians around construction activities.

Traffic

During construction, this project will add traffic to both regional roadways providing access to the project area and to local roadways abutting the Muddy River. The majority of traffic generated by the project can be attributed to hauling dried material from the staging areas and culvert construction. The total volume of trucking in this area is not anticipated to have significant impact on the traffic volumes; however, ingress and egress to staging areas will be limited during rush hours to minimize traffic impacts. Hydraulic dredging will generate 20 truck trips per day (about 4 trips per hour) and 10 trips per day for the contractor's cars. These low traffic volumes will not significantly affect traffic at nearby intersections.

The world-class Gardner Museum is located in the Fenway neighborhood

With the proposed temporary closure of Netherlands Road for use as a staging area, and the desired regional truck route to Route 9 via Brookline Avenue, the project will affect traffic at the intersection of The Riverway and Brookline Avenue. This impact is the result of added traffic to the intersection, primarily by eliminating Netherlands Road as a bypass of The Riverway/Brookline Avenue intersection for general traffic. Finally, truck traffic to/from the Daisy Field Staging Area will be routed along Pond Avenue to Cypress Street to Route 9. This truck routing avoids several congested intersections along the Jamaicaway at Perkins Street. From the northern staging areas, vehicles will use I-93 via Massachusetts Avenue as the primary route for removing material from the site.

The greatest traffic impacts are associated with culvert construction. Automobile volume to capacity ratios indicate delays will occur during the morning and evening rush hours at the intersection of Boylston Street/Park Drive and Brookline Avenue. Culvert construction across The Riverway could be completed during the day in phases. It is possible to close one lane of The Riverway without significantly affecting traffic by modifying traffic signal timing. The Brookline Avenue culvert will require a combination of day and night construction.

Noise

During culvert construction, dewatering equipment, trucks, pile driving, sheet piling, or soldier piling installation will generate noise. Culvert construction under Brookline Avenue near the former Sears parking lot will include a combination of day and night work due to the difficult traffic conditions at the Sears Rotary. Work on either end of the culvert can be constructed during the day since sufficient room exists in adjacent park areas for mobilization and work areas. Unless construction of the culvert across Brookline Avenue is done at night, new, temporary lanes for traffic will result in significant traffic impacts. The following noise mitigation measures will be undertaken:

- The regulation for the Control of Noise in the City of Boston will be followed for construction activities. This regulation restricts noise to 65 decibels (dBA) in the business zone at all times except for the operation of certain construction equipment, which is limited to 80 dBA. Similarly, the Town of Brookline will require the contractor to adhere to the Town's ordinance governing operating hours.

- On a weekly basis, the contractor will measure noise levels. Should noise levels exceed the allowed limit measured at locations indicated in the regulations, the contractor will take steps to reduce noise to levels acceptable to the Resident Engineer and responsible municipal officials.

- All construction equipment will be fitted with suitable mufflers and similar noise abatement devices prior to receiving approval to commence work.

- Drilled piling techniques will be used to reduce noise levels when installing foundation piles. Sheet piling will use vibrating driving equipment to reduce noise levels. Where foundation piles and sheet piling work cannot be done on weekdays due to traffic volumes, the work hours will be limited to stop by 11:00 PM or on weekends when traffic is lighter.

Signage

The project area should have interpretive signage.

Satisfying Regulatory Requirements and the Public

Following the Rules

MEPA

As noted earlier in this Executive Summary and further elaborated on in Sections 3 and 9 of this DEIR, the ENF for the Muddy River Project was submitted to the Executive Office of Environmental Affairs (EOEA) in January 1999. The Secretary of Environmental Affairs issued two certificates on the ENF on April 29, 1999—one for the EIR's scope and requirements and the other establishing a Special Review Procedure to accommodate an expanded public involvement process. This Draft EIR is expected to be submitted in January, 2002. Given typical allowances for regulatory review, the Final EIR is currently anticipated to be submitted in late 2002 with a final certificate issued by MEPA in early 2003.

Simmons College in the Fenway

In addition to the details of the Special Review Procedure (i.e., the designation of a Citizens' Advisory Committee (CAC), the certificate also requires Annual Updates documenting physical improvements, management practices, and information regarding current environmental conditions gathered through monitoring. The first Annual Update is anticipated to be filed one year after Charlesgate construction commences, probably during the last quarter in 2002. The Annual Update will allow local, state, and federal agencies and the public to comment on several project issues:

- Monitoring program results.
- BMP implementation.
- Dredging and other rehabilitative work.
- Work successes and shortcomings.
- Modifications to procedures to enhance work success.
- Future plans for additional work not covered in the EIR.

Project Advocates and Their Role

Project advocates include a group of public/private stakeholders with a common interest in restoring the Muddy River: Boston Parks and Recreation Department (which serves as the lead agency and is a Proponent) and the Town of Brookline (Proponent). Several other agencies and entities also have actively supported the project: The Emerald Necklace Conservancy, U.S. Army Corps of Engineers (ACOE), Massachusetts Department of Environmental Management (DEM), Massachusetts

EOEA, MDC, Federal Emergency Management Agency (FEMA), and Massachusetts Emergency Management Agency (MEMA).

In November 1999, a Memorandum of Understanding (MOU) among local proponents and state agencies involved in the project was executed. Its purpose is to facilitate cooperation among the respective authorities in project planning, permitting, funding, and implementation. The MOU allows for the transfer of funds between participating parties, provides commitments for adherence to all applicable regulatory or programmatic requirements, and summarizes Phase I financial commitments from the participants.

Other Regulatory Requirements

Regulatory requirements applicable to the Muddy River Project include the Massachusetts Wetland Protection Act (WPA) (Massachusetts General Law [MGL] Chapter 131, Section 40 and its regulations, as well as Chapter 91 and its regulations), Section 106 of the Federal Historic Preservation Act, and Section 404(b)(1) of the Federal Clean Water Act (CWA). This project will require two sets of permits—one for the proposed Charlesgate work, and one for the remaining project components (i.e., Back Bay Fens, The Riverway, and Olmsted Park and its waterways).

- The Wetlands Protection Act has eight statutory interests upon which the regulations are built. Each wetland resource area (i.e., bank, land under water, bordering vegetated wetland, riverfront area), as defined by the WPA regulations, is presumed to serve one or more of these interests. This project will be conducted under the "limited project" provisions (310 CMR 10.53) as allowed under the regulations. The local conservation commissions and the Department of Environmental Protection (DEP) share responsibility for enforcing WPA provisions. Orders of Conditions must be granted by both the Boston and Brookline Conservation Commissions.

- Historic properties are those that either are listed or are eligible for listing on the National Register of Historic Places. Section 106 of the National Historic Preservation Act requires that every federal agency "take into account" how each of its undertakings could effect historic properties. The agencies are required to work with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation. Any proposed work in the park must be reviewed by the Boston Landmarks Commission,Brookline Preservation Commission with the Massachusetts Historical Commission (in accordance with MGL Ch. 9 Sec. 26-227C as amended by Chapter 254 of the Acts of 1998). In addition, the Boston Landmarks Commission has independent review and approval of work in the Boston sections of the Emerald Necklace.

- This project will require a CWA Section 404(b)(1) permit or otherwise be a project sponsored by the ACOE. An important standard that applies under 404(b)(1) is that dredged or fill material should not be discharged into an aquatic ecosystem unless it can be demonstrated that such a discharge will not have an adverse impact on the ecosystems of concern. A Water Quality Certification also is required for the discharge of dredged material into Commonwealth waters, which require federal licenses or permits and which are subject to state water quality certification under CWA Section 401. Through this certification, DEP ensures compliance with Surface Water Quality Standards.

- A Chapter 91 Waterways permit (MGL 310 CMR 9.40) must be obtained before dredging and dredge disposal activities can occur.

Orders of Conditions

Orders of Conditions specify the type and extent of work that is permitted, not only under Phase I, but also for succeeding phases. By statute, an Order of Conditions is limited to a three-year period with extensions granted upon request. Given the complexity of the Muddy River project, it is likely that a five-year duration (three years plus two one-year extensions) will be requested. Due to the potentially variable nature of rehabilitation and other work that may take place in resource areas in subsequent years, the Orders of Conditions are likely to contain a requirement that the Proponents appear before the Conservation Commissions each year immediately following the filing of the MEPA Annual Update. Once the Secretary of Environmental Affairs issues the Certificate on the Annual Update, the Conservation Commissions may then issue amendments to the original Orders, as necessary. This is the mechanism by which the Conservation Commissions will be able to review and approve of any continuing rehabilitation within the resource areas.

Required Permits

- EIR Certificate from the Secretary of EOEA.
- Dredging permit under CWA Section 404 from the U.S. ACOE.
- Dredging permit under MGL Chapter 91 from DEP.
- Orders of Conditions from the Boston and Brookline Conservation Commissions.

Listening to Public Concerns

The CAC

Project success depends upon open communication and active involvement with the public, including individuals, community groups, environmental associations, educational and cultural institutions. To facilitate this communication, in 1999 the EOEA Secretary appointed 29 individuals representing a wide range of interest groups to serve on a CAC. The CAC's mandate was to review proposed activities, comment on the feasibility of different approaches and the likely environmental impacts, and assist the Proponents in generating and reviewing alternatives that would avoid or minimize damage to the resource. Since September 1999, the CAC has met 32 times with the project Proponents on a wide range of EIR topics. More detail can be found in Section 3 of this DEIR.

Other Communication Measures

On November 8, 2000, a Public Meeting was held summarize the project, and on December 2, 2000, the Proponents briefed the Fenway Garden Society. Technical Advisory Group meetings were held weekly starting in September 1999, and numerous meetings were held with other agencies to expand the sphere of communication and outreach. Meetings with MDC, Boston Transportation Department, Town of Brookline, BWSC, and Boston PWD were held to discuss traffic issues and how to better implement BMPs.

Boston and Brookline committed early in the project to develop a Pre-Application Review Committee (PRC) to improve the flow and timeliness of information to the permitting agencies. Sixteen people representing a wide range of state and local government formed the PRC and attended four meetings.

- On April 25, 2000, discussions focused on a project overview, the permitting process, and the sampling and analysis plans to characterize water column and sediment quality.
- On October 20, 2000, the PRC participated in a field trip to review project alternatives, newly completed wetland delineations, wildlife habitats, anticipated bank disturbance and restoration areas, and dredging methodologies.
- On December 7, 2000, discussions focused on historical and landmarks permitting.
- On March 14, 2001, the PRC met to review the DEIR's project elements and potential environmental and historic preservation overlaps in regulations.

September 1998 Site Walk with the Boston and Brookline Conservation Commissions

Protecting the Investment

Here's the Plan

Upon completion of Phase I, nearly $100 million will have been spent from federal, state, local, and private sources (see the next section, "Cost and Schedule Estimates"). To ensure this investment is protected, a Management and Maintenance Plan must be in place. This Plan must identify the management, staffing, equipment, and procedures needed to sustain the Phase I dredging, daylighting, revegetation, establishment of BMPs, and other related construction.

Specific Plan Goals

- Ensure the success of the Muddy River Project's five objectives: flood control, improved water quality, enhanced aquatic and riparian habitat, historic rehabilitation, and BMP implementation.
- Incorporate and adapt management and maintenance procedures for improved parkland.
- Identify specific problems/issues relating to maintenance operations and develop strategies to deal with them.
- Prepare a prioritized list of projects to be undertaken in the parks.
- Explore available management and maintenance resources and use them optimally.
- Assure that key parties (e.g., CAC, ENC) are involved and develop an ongoing forum for sustained communications.
- Develop a realistic schedule and standards for maintenance activities, addressing concerns of an assemblage of stakeholders.

Maintenance Activities and Resources

To maintain park assets such as lawns, trees, shrubs, walkways, benches, and other amenities as well as ancillary project aspects such as culverts, water quality, and BMPs, higher standards are necessary (e.g., additional resources for horticultural care, specialized crews for woodland maintenance, an effective mowing program, erosion control, etc.). Maintenance needs differ in each area (e.g., woodlands have different needs than parklands or river banks) and between existing park areas and new plantings, which will total 215 new trees and 24.5 acres of shrubs, wetland plants, perennials, and lawn. The chart on the page 29 describes the activities needed to meet these higher standards.

Current versus Future Maintenance Resource Needs

A detailed evaluation of current resources working in the Emerald Necklace parks revealed that between Boston, Brookline, and MDC staff, total productive time spent on maintenance activities is approximately 16,536 hours per year. To meet the higher standards recommended in this DEIR, each municipality or entity will need to provide additional staff. Details of this summary are summarized in Section 8. The Draft Maintenance Study itself is included as Appendix J. The proponents concur that the additional maintenance effort summarized in Section 8 will protect the capital investment in this unique resource. In order to close the gap, strategies include improved organization, training, better defined maintenance tasks, hiring staff, increased use of volunteers and an increased rolefor public-private partnerships.

Pest and Rodent Control

Over the past several decades, the Muddy River parks have seen an increase in duck and geese migration, in general, and more specifically, due to the abundance of food from persons feeding them. The presence of these birds has denuded the ground cover and imparted large quantities of bacteria to the water and sediments. Proactive maintenance measures to reduce the number of ducks and geese in the River include public education, local ordinances against feeding wildlife, planting of suitable plant species to form a barrier between the water and land, and implementation of reproductive and other biological controls by state and federal game officials.

Park Area	Recommended Routine Maintenance
Shrubs, perennials (planted areas)	Watering, fertilizing, mulching, pruning, pest control, winter protection, use of ground covers; identify erosion frequently and plant to control future erosion.
Turf	Mowing, watering, fertilizing, liming, aeration,turf renovation, weeding; identify erosion frequently and plant turf to control future erosion.
Water Bodies	Remove trash, water-borne vegetation, and invasives growth; monitor water quality.
Invasives	Initial large-scale removal: dredging, excavation, cutting, and hand-pulling; thereafter, a combination of cuffing, hand-application of state-controlled herbicides, and hand removal.
Trees	Pruning, fertilization, and damage protection (must have staff trained in this area).
Site Furnishings	For benches, repair, replacement, and painting. Empty trash cans, replace lights and maintain light poles, maintain drinking fountains, and remove graffiti.
Woodlands	Remove invasive species, re-establish the under story area and plant additional trees where canopies need to be filled in; maintain trials and control erosion.

Monitoring and Inspections

To ensure that Phase I improvements are maintained, the Plan includes recommendations for monitoring water/sediment quality, planting and invasives control, fish/wildlife resources, and preservation of historic character. These are discussed briefly below and further detailed in Section 8 of this DEIR.

- Water/sediment quality - conduct an annual water quality sampling program consisting of quarterly (seasonal) sampling events. Collect samples during a dry period, during precipitation, and the day following precipitation. Analyze the samples for several parameters as illustrated below. Water/Sediment Quality Sample Locations and Parameters

- Plantings/invasives - inspect the site at one, three, and five years after plantings and invasives removal to assess results and adjust future plantings as required. Continue monitoring program on a three-year cycle to ensure the health of subsequent plantings. For invasives, following initial removal, use mechanical cutting, hand-application of herbicides, and hand removal to maintain control.

- Fish/wildlife - every two years, a biologist should visit the site several times in the early and late growing seasons to document wildlife use of the habitat. Documentation will help fulfill the regulatory requirements and add to the scientific database on the Muddy River biological community.

- Historic character - inspect parks annually to evaluate historic preservation methods and adjust maintenance efforts (character- and defining-features to be monitored are listed on page ES-31).

Water/Sediment Quality Sample Locations and Parameters

Within the Muddy River

- Ipswich Street
- Agassiz Road
- Boston Gate Houses
- Fens Bridge
- Longwood Avenue Bridge
- Outlet of Levereff Pond
- Outlet of Willow Pond
- Outlet of Wards Pond

Drainage Outfalls

- Emmanuel College Drain
- Longwood Avenue Drain
- Tannery Brook Drain
- Huntington Avenue
- Village Brook Drain
- Daisy Field Drain
- Chestnut Street Drain

Sample Parameters

- Fecal Coliform Bacteria
- Fecal Streptococcus Coliform Bacteria
- Total Suspended Solids (TSS)
- True and Apparent Color
- Total Phosphorus
- Orthophosphate Phosphorus
- Turbidity
- Alkalinity
- Acidity
- Ammonia Nitrogen
- Nitrate-Nitrite Nitrogen
- Metals
- TPH-EPH

Best Management Practices (BMPs)

BMPs, used to ensure effectiveness and reduce the need for future capital costs, are recommended for structural improvements (e.g., new culverts), source control (e.g., erosion prevention and catch basins), and treatment controls (e.g., vegetated swales). Maintenance for each of these BMPs is discussed below and further detailed in Section 8 of this DEIR.

- Structural - maintenance involves cleaning/inspection at regular intervals. Specifically, for new culverts, remove accumulated debris or sediment and repair structures; clear blockages when discovered; annually, inspect culverts for structural integrity.

- Source Control - some examples of maintenance for these BMPs include annual inspection of adjacent roadways and curbs, continual updates of the catch basin database and regular catch basin cleaning, augmentation of street sweeping program and regular maintenance of equipment, replanting of grass/ vegetation along trials every spring and fall, and implementation of an ongoing public education program.

- Treatment Control - for vegetative swales, regular mowing, monthly inspection to check for erosion, and prompt reseeding of damaged areas; every five years, scrape swale bottoms and remove sediment to restore original cross-section and infiltration rate. For particle separators, conduct seasonal inspections for first year of operation; thereafter, clean system annually. For sedimentation basins, monitor sand bar formation annually.

Specific Storm Events

Such routine maintenance, monitoring, and inspection as described above must be supported by specific preventative and corrective measures following a large storm event.

- Preventative - prior to large storms, conduct a site walkthrough to identify and remove trees or debris blocking culverts or bridge openings.

- Corrective - inspect and immediately clean catch basins to remove sediment deposited by the storm; rehabilitate eroded stream banks and pedestrian trials; and remove debris such as fallen tree branches and litter.

To manage flooding, a major emergency action plan was developed with the cooperation of all interested parties. The plan includes four stages: Alert, Warning, Operation, and Cessation of Event. Specific activities involved in each stage are outlined in Section 8.

Accountability and Management:

The City of Boston and Town of Brookline will share responsibility for implementing the Maintenance Plan summarized above and further detailed in Section 8. They will use the following tools to prove their commitment and ensure long-term project success.

- Memorandum of Understanding - commits the proponents to funding maintenance in return for state assistance in capital expenditures.
- Quality Assurance Program - logs/ monitoring reports will document that the project is meeting its objectives.
- MEPA Annual Updates (AUs) - these updates will inform the Secretary of Environmental Affairs and public of project progress; the CAC will review the draft AU 30 days prior to submission to MEPA, ensuring their continued contribution.
- Guidance from state agencies on activities that require permits - for example, Department of Army Permit under Section 404 of CWA, Permit to Dredge under MGL Ch. 91 from DEP, etc.; see earlier section of Executive Summary for a detailed list of permits.

Historic- and Character-Defining Features (as defined by the National Park Service) To Be Inspected Annually

- Spatial relationships
- Views and vistas
- Topography
- Circulation systems and site entries
- Vegetation
- Water features
- Furnishings and structures

While Boston and Brookline are ultimately responsible for the parks' rehabilitation, a park management structure will ensure consistent oversight of park areas and advocacy to support and provide the resources to maintain these areas over the long-term. Following are possible alternatives for an initial management structure. As with other successful park management structures, this initial framework will evolve over time. More detail on each alternative is provided in Section 8.

Description	Frequency of Reporting	Responsible
Update Maintenance Operations Plan	Annually	Management Group
Maintenance Logs	Annually	Maintenance Supervisors
BMP Monitoring/Maintenance Logs	Annually	Maintenance Supervisors
Pest Control Programs	Annually	Management Group
Water Quality Monitoring Program	Annually	Management Group
Report on Plantings	Years 1,3,5 Every 3 yrs after	Horticulturist
Report of Aquatic and Wildlife Distribution	Bi-Annually	Management Group/Biologist
Report on Historic/Character Defining Features	Annually	Management Group/ Landscape Architect

Summary of Monitoring and Inspection Program

- Existing Management Structure (status quo) - Currently, Boston, Brookline, and the MDC each maintain a portion of the Emerald Necklace park area and are responsible for its maintenance; although there is increased cooperation and collaboration among the partners, no one entity coordinates the park crews to ensure consistency, or that work is conducted according to a specific set of standards.

- Cooperative Management Structure - Under this structure, Boston, Brookline, and MDC would continue to maintain their respective park sections, but would do so in concert with a unified plan. One representative from each entity (commissioner or director level) would cooperatively set policy and goals for park maintenance and BMPs. Assisting this group would be horticulturists, arborists, and maintenance supervisors or operations managers.

- Public/Private Partnership - These types of management structures can take many forms; research into other park systems revealed that such partnerships usually take the form of a conservancy leading the organization with the public entity providing portions of staffing and funding. Currently, the Emerald Necklace Conservancy (ENC) is active, but is nonetheless a relatively young and growing organization. As the ENC matures over time, it may well generate the resources and funding other successful park Partnerships enjoy.

- Entity Under the Environmental Joint Powers Act - To facilitate intergovernmental action on natural resource and environmental issues, Massachusetts' law allows two or more public agencies to enter into an agreement to jointly exercise jurisdiction and responsibilities over specific areas. A local example is the Upper Mystic River Watershed Agency - nine communities who have formed an agency to address flooding problems. One weakness of such an agency concerns funding (its member communities are not obligated to provide funding). If the agency's work is limited to coordinating actions and expending study funds, it can be successful; however, if more ambitious projects are conducted, annual appropriations may become problematic.

- Park Commission or Authority - Massachusetts' law also allows commissions or authorities to be formed to lead an organization dedicated to a specific public purpose. The actual organizational structure can vary significantly, but, in simple terms, a commission or authority is a central organization with a structure separate from the towns/cities involved. Sources of funding are a weakness of this kind of structure, since the parks are generally not revenue generating entities, an appropriation from the owning agencies, or outside funding, must be obtained. Therefore, a successful park authority or commission is only possible with sufficient political support in the member communities to cede control of park areas and secure adequate funding streams.

Irrespective of which alternative is selected, it should consider using several resources, such as the ENC, community councils, the CAC, and volunteers.

Paying the Bills

Capital Budget

The projected cost of the Muddy River Restoration Project is approximately $91.1 million (see Section 10). Subtracting the $7 million (which, in part, includes early action on Charlesgate) allocated to the project, the remaining capital funds needed amount to roughly $84 million. This budget will include the design and construction of the remainder of the project (upstream of Charlesgate) and the capital costs for the treatment control or "structural" BMPs in the watershed.

A funding strategy for the additional capital costs has been formulated involving federal, state and municipal funding. The U.S. Army Corps of Engineers has been authorized by the Congress in the Water Resources Development Act of 2000 (WRDA2000) to undertake the Muddy River project for flood damage reduction and environmental restoration. Also, the Commonwealth of Massachusetts has committed to provide significant capital funding. The municipalities of Boston and Brookline, having been partners with the state and federal agencies in funding the first $7 million, are committed to obtaining capital funds to supplement the federal and state sources. Finally, the City of Boston and the Town of Brookline, co-proponents, in partnership with the Commonwealth will explore other potential federal, state and local funding sources to supplement the major funding sources.

Getting Started

Construction Phasing and Schedule

Construction phasing of the project (see Section 5 for details) will be dependent on the sources of funding and timing of when funds can be appropriated and obtained.

Funding for the Charlesgate portion of the project has been secured and the project has been designated by the Secretary of Environmental Affairs to proceed if sufficient information is included in the DEIR to address the environmental issues. The Charlesgate portion of the project includes dredging in the Charlesgate area and removing several obstructions under bridges between Boylston Street and the Charles River. Bidding is expected to start in the Spring of 2002 upon receipt of the Secretary's certificate for the Draft EIR. Construction should be completed by late 2002.

Construction phasing for planning purposes on the remainder of the Phase I Project is currently assumed to be a single construction project. Under these circumstances, the bidding is not expected to occur until the Secretary issues a Certificate on the Final EIR.

Anticipated Muddy River Phase I Construction Schedule

Bid Charlesgate	Spring 2002
Start Charlesgate Construction	Summer 2002
Complete Charlesgate Dredging	End of 2002
FEIR Certificate	Early 2003
Bid Muddy River	Early 2003
Start Muddy River Construction	2003
Complete Muddy River	2006

Assuming a Certificate on the Final EIR is issued in early 2003, the bidding could begin in the winter of 2003, with construction commencing in 2003 and completion anticipated in 2006. This schedule is dependent on the appropriation of federal, state and municipal capital funds.

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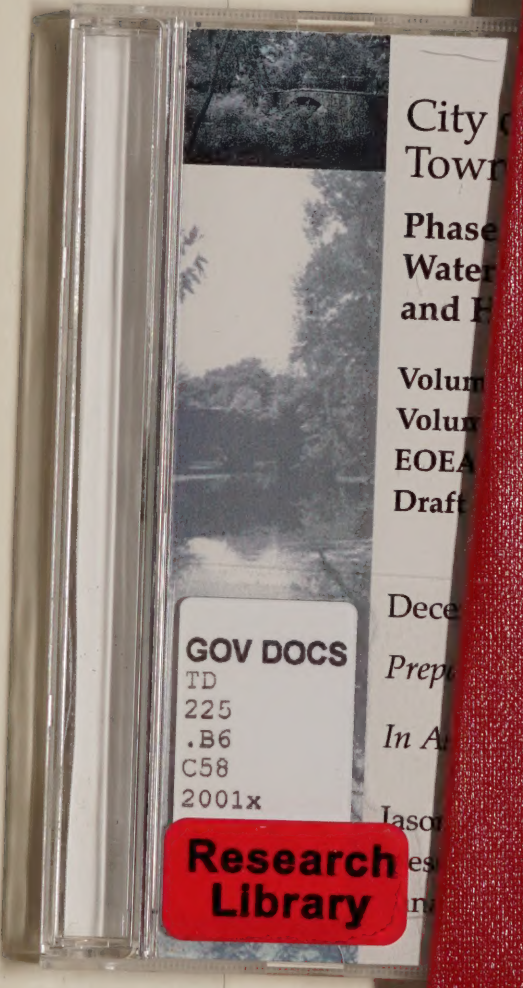

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